A Study on Effects of Severity of Cigarette Smoking On Lung Functions of Adult Population in North Gujarat Region

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Abstracts: Backgrounds And Objectives: Tobacco consumption in different forms is a common addiction in the socio-economically handicapped population in many developing countries there are few data on the uantitative effects of cigarette smoking on lung function in young adults. These effects are important in the understanding of the early stages of chronic airflow obstruction. **Material and method:** Our study was performed on a total of 100 subjects (50 control and 50 were cigarette smokers) with the age group between 15-40 years were selected. Smokers were categorized into mild, moderate and severe smokers on the basis of number of cigarette smoke per day. Computerised spirometery examination was performed on both control and smokers. **Results and Interpretation:** We observed an inverse dose–response relation between smoking and FEV1, FVC, FEV1/FVC, PEFR; FEF etc. severe smokers had a low FEV1, PEFR, and FVC than control group. **Conclusion:** Cigarette smoking has a dose related adverse effect on the evolution of ventilatory lung function in young adulthood. Cigarette smoking is associated with evidence of airway obstruction and slowed growth of lung function in adults, exposure to cigarette smoke led to a greater increase in the number of mucus-producing tracheal goblet cells that enhanced the airway obstruction that may be the cause for decline in the lung functions. [Patel K NJIRM 2014; 5(6):39-43]

Key Words: FVC, FEV1, PEFR, Spirometery, Cigarette Smoking.

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Introduction: Understanding the early evolution of ventilatory impairment is important for the prevention of chronic obstructive pulmonary disease as this disease develops gradually over time and symptoms severe enough to raise concern appear at a late stage of the disease. Cigarette smoking has been identified to be the most important determinant of ventilatory impairment.[19,20]

Although tobacco abuse in any form is a widely recognized health hazard and a major cause of mortality, people continue to consume it on a regular basis. According to the world health organization (WHO) approximately one third of world population older than 15years, are consuming tobacco.[1,2,3]

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 FEV, in adults. "Only Fletcher et al and Peat et al have reported quantitative estimates of the association between the numbers of cigarettes smoked and the rate of decline of FEV1.[17,18]

Today smoking has been established as a number one preventable cause of death and disease in the countries worldwide. About 30-40% of the all the death from cancer are associated with tobacco consumption. Recent data suggest that smoking is not only associated with lung cancer but also associated with increased incidence of cancer in larynx, oral, esophagus, cervix, bladder, pancreas and even leukemia . Cigarettes smoke contain a large number of substances including nicotine, carbon monoxide and recognize carcinogens and mutagens such as radioactive polonium, benzopyrene, dimethylnitrosamine.[2,3]

Smoking seemed to affect only a subgroup of smokers, suggesting a susceptibility that could be affected by other environmental hazards. The determinants of susceptibility to the effects of smoking have been difficult to identify. Several other probable determinants of ventilatory function have been recognised, including genetic factors, atopy, non-specific airways hyperresponsiveness, childhood respiratory illness, the presence of respiratory symptoms, socioeconomic status, alcohol consumption, exposure to environmental tobacco smoke, outdoor air pollution, and certain occupational exposures. In our study of the effects of smoking

on lung function in young adults we found that the adverse effects of smoking were limited to a subgroup of subjects mainly to the moderate and severe smokers. The objectives of the present study were to estimate quantitatively the effect of cigarette smoking during the study period on change in ventilatory function in young adult population.

Material and Methods: The study was conducted on 100 cases (50 control and 50 smokers). The subjects, enrolled for the study were informed about the study and procedural details and an informed consent was obtained. Subjects enrolled for the study from high school, college and general population from society. The subjects were between the ages of 15 – 40 years. None of the subjects had past history of any major pulmonary disease. Other major clinical illnesses were ruled out by detailed history and careful relevant clinical examination.

Clinical Assessment: A detailed history and physical examination was conducted and patients were categorized according to the frequency of cigarette smoke per day. Mild smokers when 1- 10 cigarettes smoke per day, moderate smokers when 11-20 cigarettes a day and severe when more than 20 cigarettes a day.

Standard anthropometric measurements: Weight (kg), and Height (cm), were measured on a beam balance. The above parameters were used to calculate the Body Mass index and Body Surface Area was calculated by data of height and weight entered in the computer.

Resting pulse rate and Blood Pressure was measured in sitting position after five minutes of complete rest.

Spirometric Pulmonary Function Testing: Medi: SPIRO (Medical Equipment and Computer Systems (I) Ltd.) Software was employed for the computer-aided spirometry. Name, age, height, weight, etc. of the subject was entered. This enabled calculation of age and height predicted values calibrated to Indian standards. The subjects were demonstrated the maneuvers and were allowed rehearsal. After enough practice, subjects performed

Spirometry to Record:
Forced Vital Capacity- expiratory and inspiratory (FVC and FIVC and its components).
Forced expiratory volume FEV1

For recording FVC, the subjects were instructed to take a deep and maximum inspiration and breathe out as forcefully as, as fast as and as complete as possible. Graphic records and values of FVC and its components were obtained. The data was obtained through ink-jet printer. Computerized spirometry record shows the following parameters:

a) Forced Vital Capacity (FVC)
b) Forced Expiratory Volume at the end of the 1st second (FEV1)
c) Ratio of Forced Expiratory Volume in 1 second and Forced Vital Capacity (FEV1/FVC)
d) Peak Expiratory Flow Rate (PEFR and PIFR)
e) Forced Expiratory Flow (at 25%, 50%, and 75% of expired volume)
f) FEF25-75% (formerly known as MMEFR or Maximum Mid- Expiratory flow Rate)

Statistical Analysis: Data was expressed as mean value ± standard deviation and comparisons between the three groups were performed using one-way analysis of variance (ANOVA), and unpaired t test was used for comparisons between two groups.

Result:

Table 1: COMPARISON OF DIFFERENT PARAMETERS BETWEEN CIGARETTE SMOKERS AND CONTROL GROUP

Parameters	Control	Cigarette smokers
FVC(Litre)	3.55+0.57	3.31+0.71**
FEV1(Litre)	3.02+0.45	2.84+0.61**
FEV1/FVC(%)	85.84+10.83	90.52+6.75
FEF25-75 (Litre/sec)	3.65+0.73	4.12+1.05
PEFR(Litre/sec)	7.36+1.46	6.24+1.42**

**Highly significant

Graph 1:

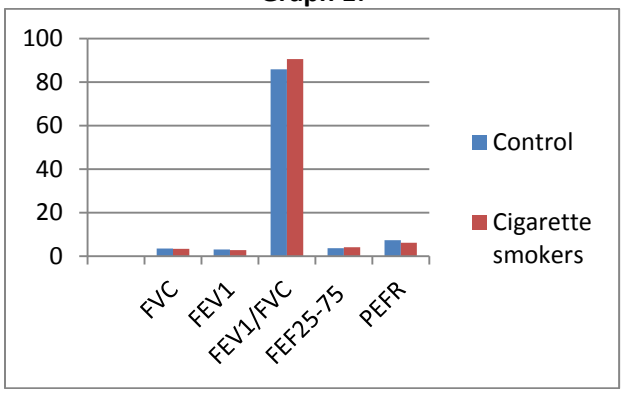
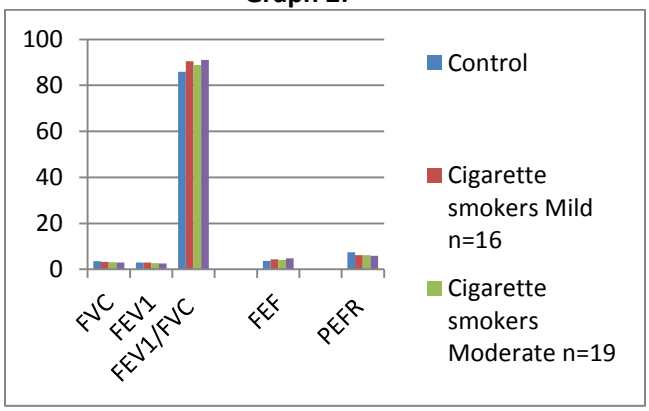


Table 2: Comparison of Different Parameters between Control Group and Mild, Moderate and Severe Cigarette Smokers

Parameters	Control	Cigarette smokers		
		Mild n=16	Moderate n=19	Severe n=15
FVC(Litre)	3.55±0.57	3.21±0.74	3.10±0.68	2.98±0.85
FEV1(Litre)	3.02±0.45	2.93±0.69	2.69 ± 0.81	2.61±0.67
FEV1/FVC (%)	85.84± 10.83	90.52±6.75	88.76±8.75	91.02±4.89
FEF 25-75 (Litre/sec)	3.65±0.73	4.30±1.05	4.02±1.93	4.81±1.02
PEFR (Litre/sec)	7.36±1.46	6.24±1.42	6.12±1.98	5.91±2.04

**Highly significant

Graph 2:



Studies of pulmonary function among asymptomatic smokers have demonstrated that, as a group, they show significant impairment of almost all parameters of lung function according to the study of Chiang ST et al, Finley TN et al, Green GM et al and many others . Ventilatory function parameters were within the predicted normal range in controls. From above table 1 and 2 our study showed that almost all the pulmonary parameters (FEV1, FVC, PEFR, FEF25-75%) are decreased in smokers as compared to non-smokers.

Discussion: Our first objective was to provide a quantitative estimate of the effect of cigarette smoking on change in ventilatory lung function ove in adults. Bruce D. Johnson et al data states that "Smokers tended to have a greater reduction in FVC, FEV1 and FEV1/FVC relative to nonsmokers. Values for FVC, FEV1, FEF and FEV1/FVC for smokers were 2.85±0.10 liters, 1.98±0.09 liters, 1.54±0.11 liters/sec and 69±2% respectively and those for non-smokers were 3.57±0.11 liters, 2.72±0.08 liters, 2.25±0.10 liters /sec and 77±1 % respectively. While according to Alexander V. Prokhorov et al the mean forced expiratory volume in 1 sec/forced vital capacity ratio in smokers and non-smokers was 90.51% and 94.59% respectively, peak expiratory flow rate in smokers and non-smokers was 80.32% and 92.06% respectively.

Mean FEV1: Details of our study showed (Table No-1,2) that the mean FEV1 levels in non-smokers and smokers were 3.02+0.45Litres and 2.84+0.61Litres respectively. The FEV1 levels in subjects smoking 1-10 cigarettes per day was 2.93±0.69Litres and those smoking 11-20 cigarettes per day was 2.69 ± 0.81Litres, while those smoking more than 20 cigarettes per day was 2.61±0.67Litres. These findings are in tune with findings of Kimberley D. Clark et al , Bruce D. Johnson et al ,Alexander V. Prokhorov et al and many others [6,16,17,18,19,20]

Mean FVC: Details of our study showed (Table No-1,2) that the mean FVC levels in smokers was less than that of smokers . The FVC levels in subjects smoking 1-10 cigarettes per day was 3.21+0.74 Litres and those smoking 11-20 cigarettes per day was 3.10±0.68Litres, while those smoking more than 20 cigarettes per day was 2.98±0.85Litres. These findings are in tune with findings of Kimberley D. Clark et al, Bruce D. Johnson et al , Alexander V. Prokhorov et al and many others.[6,10,16,1718,19,20]

The mean values of PEFR, FEF25-75 and FEV1/FVC were also lower in smokers than control group, decline in parameters were more in moderate and severe smokers than controls.

It is apparent in reviewing these studies that almost all pulmonary parameters are decreased in smokers as compared to non-smokers however, that many individual smokers exhibit completely normal pulmonary function, although this point is emphasized by only a few author.

References:

1. Anderson DO, Ferris BG Jr, Zickmantel R. The Chilliwack Respiratory Survey, 1963. IV. The effect of tobacco smoking on the prevalence of respiratory disease. Can Med Assoc J 1965;92:1066-76.
2. Armitage AK, Ashford JR, Gorrod JW, Sullivan FM. Environmental tobacco smoke – is it really a carcinogen? Med Sci Res 1997; 25 : 3-7.
3. Ashakumary L, Vijayammal PL. Additive effect of alcohol and nicotine on lipid peroxidation and antioxidant defence mechanism in rats. J Appl Toxicol 1996; 16 : 305-8.
4. Auerbach 0 , Hammond EC, Garfinkel L, et al: Relation of smoking and age to emphysema: Whole-lung section study. N Engl J Med 286:853, 1972 6.
5. Bruce D. Johnson, PhD; Kenneth C. Beck, PhD; Lyle J. Olson, MD; Kathy A. O'Malley; Thomas G. Allison, PhD; Ray W. Squires, PhD and Gerald T. Gau, MD. Pulmonary Function in Patients With Reduced Left Ventricular Function-Influence of Smoking and Cardiac Surgery. Volume 120:1869-1876. 2001
6. Chiang ST, Wang BC: Acute effects of cigarette smoking on pulmonary function. Am Rev Resp Dis 101:860, 1970
7. Craig WY., Palomaki GE., Haddow JE. Cigarette smoking and serum lipid and lipoprotein concentrations: an analysis of published data. BMJ 1989;25: 784-8.
8. Dominic J. Cirillo, Yuri Agrawal, and Patricia A. Cassano. Lipids and Pulmonary Function in the Third National Health and Nutrition Examination Survey. American Journal of Epidemiology, Am J Epidemiol Vol. 155, No. 9, 2002
9. Finley TN, Ladman AS: Low yield of pulmonary surfactant in cigarette smokers. N Engl J Med 286:223, 1972
10. Friestad C, Pirkis J, Biehl M, Irwin CE. Socioeconomic patterning of smoking, sedentary lifestyle, and overweight status among adolescents in Norway and the United States. J Adolesc Health 2003;33:275–8.
11. Green GM, Carolin D: The depressant effect of cigarette smoke on the in vitro antibacterial activity of alveolar macrophages. N Engl J Med 276:421, 1967
12. Huhti E: Ventilatory function in healthy non-smokers and smokers. Scand J Resp Dis 48: 149, 1967
13. Kato takahiko .Effects of Smoking on Pulmonary Function: A Cross-sectional and Longitudinal Study. Journal of UOEH vol: 23 issue: 4 page: 403-409 year: 2001.
14. Loomis TA: Bronchoconstrictor factor in cigarette smoke. Proc Soc Exp Biol Med 92:337, 1956
15. Morris IF. Koski A. Iohnson Le. Spirometric standards for healthy nonsmoking adults. Am Rev Respir Dis 1971.103 : 57.
16. Peters JM, Ferris BG Jr. Smoking, pulmonary function, and respiratory symptoms in a college-age group. Am Rev Respir Dis 1967;95:774-82.
17. Prokhorov AV, Emmons KM, Pallonen UE, Tsoh JY. Respiratory response to cigarette smoking among adolescent smokers: a pilot study. Prev Med 1996; 25; 633-40
18. Shapiro W, Patterson JL Jr: Effects of smoking and athletic conditioning on ventilatory mechanics, including observations on the reliability of the forced expirogram. Am Rev Resp Dis 85:191, 1962
19. Sinha AK., Misra GC., Patel DK. Effect of cigarette smoking on lipid profile in the young. Journal Assoc. of Physician India 1995; 43: 185-8.
20. Tager IB, Munoz A, Rosner B, Weiss ST, Carey V, Speizer FE. Effect of cigarette smoking on the pulmonary function of children and adolescents. Am Rev Respir Dis 1985;131:752-9.
21. Traber MG, Van der Vliet A, Reznick AZ, Cros CE. Smoking and pulmonary and

cardiovascular diseases. Clin Chest Med 2000;2:173-87.
22. Walter S, Nancy NR, Collier CR. Changes in the forced expiratory spirogram in young male smokers. Am Rev Respir Dis 1979;119:717-24.
23. Woolf CR, Suero JT: The respiratory effects of regular cigarette smoking in women. Am Rev Resp Dis 103:26, 1971.
24. www.hlm.nih.gov/medlineplus/aboutmedlineplus.html - Pulmonary function tests.

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