ORIGINAL ARTICLE

COMPARATIVE STUDY OF PEAK EXPIRATORY FLOW RATE AND MAXIMUM VOLUNTARY VENTILATION BETWEEN SMOKERS AND NON-SMOKERS

Karia Ritesh M[1]

[1]Assistant Professor, Department of Physiology, GMERS Medical College & Hospital, Dharpur-Patan, Gujarat

Correspondence
Dr. Ritesh M. Karia
C-1/5, Doctors' Quarter, GMERS Medical College & Hospital,
Dharpur-Patan, Gujarat, India
Email : riteshkaria@ymail.com
Contact No.: 9033034007

ABSTRACT

Objective: Objectives of this study is to study effect of smoking on Peak Expiratory Flow Rate and Maximum Voluntary Ventilation in apparently healthy tobacco smokers and non-smokers and to compare the result of both the studies to assess the effects of smoking
Method: The present study was carried out by computerized software of Pulmonary Function Test named 'Spiro Excel' on 50 non-smokers and 50 smokers. Smokers are divided in three gropus. Full series of test take 4 to 5 minutes. Tests were compared in the both smokers and non-smokers group by the 'unpaired t test'. Statistical significance was indicated by 'p' value < 0.05.
Results: From the result it is found that actual value of Peak Expiratory Flow Rate and Maximum Voluntary Ventilation are significantly lower in all smokers group than non-smokers. The difference of actual mean value is increases as the degree of smoking increases.

Key Words: Effect of smoking, Peak Expiratory Flow Rate, Maximum Voluntary Ventilation,

INTRODUCTION

'Smoking Is Injurious To Health' is written in almost all the tobacco containing products. Despite this tobacco smoking is widely prevalent in developed as well as developing countries[8]. Smoking has significant detrimental effects on various system on the body. Tobacco smoke is mixture of more than 4000 compunds[7]. Out of these many compounds are known to be carcinogenic and toxic. It can cause various pathophysiological effects. It has been identified as the most important risk factor in Chronic Obstructive Pulmonary Disease (COPD)[3]. It significantly increases progressive deterioration of lung function. Pulmonary Function Test is a test to examine functional capacity of lungs and respiratory system. The common parameters measured in pulmonary function test are Peak Expiratory Flow Rate (PEFR) and Maximum Voluntary Ventilation (MVV).

MATERIAL AND METHOD

The present study was carried out at Pulmonary Function Lab, department of Physiology, Govt. Medical College, Bhavnagar in 100 male subjects. Out of them 50 were non-smokers and 50 were smokers. Prior written permission was taken from Institutional Review Board.(IRB). All the smokers had history of smoking since last 5 years. Smokers are divided in three gropus[9]. :

Group 1: Mild Smokers –A person who smokes 10 or less than 10 tobacco products per day

Group 2: Moderate Smokers – A person who smokes more than 10 but less than 20 tobacco products per day

Group 3 : Heavy Smokers – A person who smokes more than 20 tobacco products per day

The control group (non-smokers) was comparable in age, sex, economic status, socio-physical activity to study group. The Inclusion and Exclusion criteria were as follows.

Inclusion criteria:

- Age range: 15 to 45 years
- Non smokers: Never smoked
- Smokers: Smoking since last 5 years

Exclusion criteria:

- Evidence of any CVS disease

- History of acute respiratory illness preceding 6 week
- Any thoracic or spinal or muscular deformity
- History of drug intake like beta blocker, steroid at the time of study
- Any lung malignancy

The present study was carried out by computerized software of Pulmonary Function Test named '**SPIRO EXCEL**'. Spiro Excel is an instrument designed for lung function screening; the core of the system is the 'intelligent' flow meter that, connected through the USB cable, turns any personal computer (laptop or desktop) in a complete spirometric lab.

Spiro Excel is designed in such a way that it is easy and simple to operate and give highly accurate results. With the help of Spiro Excel it is easy to analyze data and it gives accurate result without manual calculation according to standardize testing protocol and predictions.

Subject Preparation

All subjects were physically healthy, without any symptoms. The experimental protocol was explained to all the subjects and written consent was obtained from them. Subject was explained and demonstrated about the procedure to be performed. All anthropometric measurement (age, height and weight) were obtained in the subjects wearing light-weight clothing and barefoot and at room temperature. All vital Data (temperature, pulse, respiratory rate and blood pressure) was collected in sitting position after making subject relax and calm[2]. General Examination and Systemic Examination (complete RS and CVS examination) was done according to standard protocol. They were allowed to do enough practice, as lung volume depends on the subject's making a maximal voluntary effort. Full series of test take 4 to 5 minutes.

Following activities was avoided prior to test which was approved by American Thoracic Society(ATS)[4].

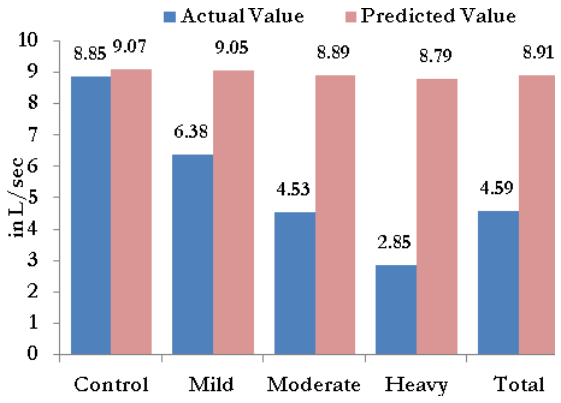
- Smoking within at least 1 hr of testing
- Consuming alcohol within 4 hr of testing
- Performing vigorous exercise within 30 min of testing
- Wearing clothing that substantially restricts full chest and abdominal expansion
- Eating a large meal within 2 hr of testing.

Statical Analysis

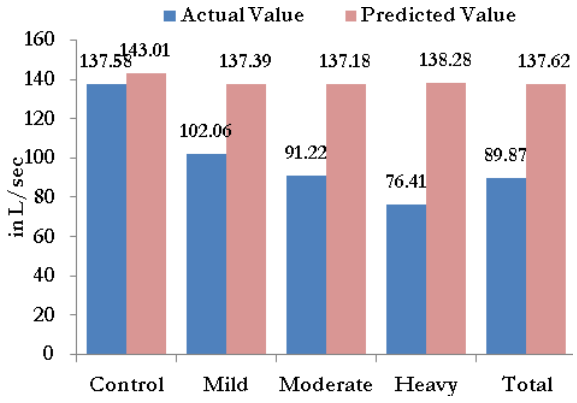
The value of PEFR and MVV were compared in the both smokers and non-smokers group by the 'unpaired t test'. Data were expressed in mean $\pm$ SD. Statistical significance was indicated by 'p' value < 0.05.

RESULTS

Actual value and predicted value of PEFR and MVV are shown in Graph 1 and 2.



Graph 1: Comparison between actual mean value and predicted mean value of Peak Expiratory Flow Rate



Graph 2: Comparison between actual mean value and predicted mean value of Maximum Voluntary Ventilation

DISCUSSION

Bajentril AL, Veeranna N (2003) studied that 2-5 years of tobacco smoking tends to a definite tendency to narrowing of both the large and small airways and significantly lowering lung function[1].

Ferris and Cotes showed a decrease in diffusing capacity in cigarette smokers and this was probably related to a lower pulmonary capillary blood volume in smokers compared with non-smokers[11].

Kim WD (1985) studied that smokers have fewer alveolar attachments than non-smokers and that loss of alveolar attachments represents an early stage in the destruction of lung parenchyma[5].

Chatterjee S, Nag SK et al. (1988) studied on 334 healthy male non-smokers and 300 healthy male smokers of the age range of 20-60 years and found that value of MVV and PEFR is significantly lower in smokers than non-smokers[10].

K. M . Padmavath (2008) studied that MVV showed significant reduction ($p<0.0001$) in smokers than non-smokers possibly due to reduction in respiratory muscle strength[6].

Graph 1 shows actual and predicted mean value of PEFR (in L/Sec) in control as well as mild, moderate and heavy smokers. Actual mean value of PEFR in control is 8.85 $\pm$ 1.84, while predicted value is 9.07 $\pm$ 1.20. Actual mean value of mild, moderate, heavy and total smokers are 6.38 $\pm$ 0.34, 4.53 $\pm$ 0.28, 2.85 $\pm$ 0.26, 4.59 $\pm$ 1.50 respectively. Non-smoker group shows non-significant change in PEFR value than their predicted value. Smokers groups shows significantly lower value than their predicted value. The difference of actual value and predicted value of PEFR increase as the degree of smoking increases.

Graph 2 shows actual and predicted mean value of MVV (in L/min) in control as well as mild, moderate and heavy smokers. Actual mean value of MVV in control is 138.21 $\pm$ 12.85, while predicted value is 143.01 $\pm$ 12.45. Actual mean value of mild, moderate, heavy and total smokers are 102.06 $\pm$ 6.95, 91.22 $\pm$ 7.78, 76.41 $\pm$ 8.05, 89.87 $\pm$ 13.06 respectively. Non-smoker group shows non-significant change in MVV value than their predicted value. Smokers groups shows significantly lower value than their predicted value. The difference of actual value and predicted value of MVV increase as the degree of smoking increases.

CONCLUSION

Therefore, it is concluded that value of Peak Expiratory Flow Rate and Maximum Voluntary Ventilation are lower in active tobacco smokers than tobacco non-smokers. The actual value of PEFR and MVV is decrease as the number of tobacco smoking products increase. Therefore pulmonary function is lower in moderate smokers than in mild smokers and lower in heavy smokers than in mild and moderate smokers. Lower pulmonary function are associated with greater risk for lung disease, cardiovascular disease, cancer and other disease.

So, aggressive tobacco control programme aimed to inform the public about the hazards of tobacco use and to provide restriction on the use of or purchase of tobacco must be started. This will be helpful to change policies towards tobacco use, in order to prevent tobacco induced morbidity and mortality.

ACKNOWLEDGMENT

We are thankful to subjects who give us permission to study on them and made this study possible.

REFERENCE

1. Bajentri AL, Veeranna N. Effect of 2-5 years of tobacco smoking on ventilator function test. Indian Med. Association 2003 ; 1017 : 96-7, 108
2. Brusasco, R. Crapo and G. Viegi. Series ATS/ERS Task Force: Standardisation Of Lung Function Testing. Eur Respir J 2005; 26: 153–161
3. J.F. Nunn ; Nunn's applied respiratory physiology 4th edition ; 378-83
4. Joshi A,. Correclation of Pulmonary Function Tests with Body Fat Percentage in young Individuals. Indian J Physio Pharmacol 2008; 52 (4) 383-388.
5. Kim WD, saettam M, Ghezzo H. Loss of alveolar attachments in smokers. A morphometric correlate of lung function impairment. Am Rev. Respir. Dis. 1985, 132 : 814-900
6. K. M . Padmavath Comparative Study Of Pulmonary Function Variables In Relation To Type Of Smoking. Indian J Physio Pharmacol 2008; 52 (2) 193-196
7. Newcomb PA. The health consequences of smoking cancer : cigarette smoking. Med CI North Am 1992; 76 : 305-31
8. Prohibition of Advertisement and Regulation of Trade and Commerce, Production, Supply and Distribution Act, 2003
9. R.W.Colin. Clinical Findings, Sputum Examinations, and Pulmonary Function Tests Related to smoking Habit of 500 women. Chest 1974;66;652-659.
10. S. chatterjee, Nag SK, Dey SK. Spirometric Standards for Non-Smokers and Smokers of India (Eastern Region). Japanese Journal of Physiology, 38, 283-298, 1988
11. Van Ganse WF, Ferris BG, Cotes JE: Cigarette smoking and pulmonary diffusing capacity (transfer factor). Am Rev Resp Dis 105:30, 1972