ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 01 | January - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARISON OF MAXIMUM MID EXPIRATORY FLOW RATE BETWEEN ASYMPTOMATIC TOBOCCO SMOKERS AND TOBOCCO NON-SMOKERS

Medical Education

Dr. Jiya Michael ASST. Professor, DEPT. of Physiology, SUT Academy of Medical Sciences, Trivandrum.

Dr. Aswathy. L Associate Professor, DEPT. of Physiology, Dr. SMCSI Medical College, Trivandrum.

Dr. Sunayana Mathew ASST. Professor, DEPT. of Physiology, SUT Academy of Medical Sciences, Trivandrum.

Dr. Josephine Vincent* ASST. Professor, DEPT. of Physiology, SUT Academy of Medical Sciences, Trivandrum. *Corresponding Author

ABSTRACT

Smoking is one of the leading causes of preventable and premature death all over the world. It also causes diseases like asthma, chronic bronchitis and emphysema. The study was conducted to find out the effect of smoking on smaller airways by measuring maximum mid expiratory flow rate (MMEFR).It was found that the MMEFR was significantly reduced in smokers compared to non- smokers. The key method to prevent the development of asthma and COPD is to identify the smokers at an earlier stage of disease so that they can be encouraged to stop smoking. Regular screening should be done in smokers to assess their pulmonary functions.

KEYWORDS

Smoking, Asthma, Maximum mid Respiratory flow rate

INTRODUCTION

Cigarette smoking is considered as a major preventable cause of death. It is an important public health problem and causes many diseases like asthma, chronic bronchitis and emphysema around the world (1). According to WHO, 300 million people in India are cigarette smokers which include 195 million males, 50 million females and 5 million in the age group 10- 15 years(2). Smoking is a common habit of people in both urban and rural areas of India.

Respiration is the major integrator of all biological processes and it act as motor of life. So when the respiratory system fails, life is in danger .The term small airway generally refers to airways with an inner diameter of about 2mm and do not have cartilage. Studies have shown that these small airways are main site of airway obstruction in respiratory diseases like asthma and COPD (3).

Smoking causes inflammation, squamous epithelium metaplasia and mucus plug formation in small airway which eventually leads to structural changes in the alveoli. Since these effects are directly proportional to the rate of smoking, smoking is the prime etiology in chronic lung disease (4).

Asthma and COPD which are most prevalent diseases caused by smoking are characterized by personal, social and economic impact. These diseases cause significant economic burden including hospitalization, absence from work and disability (5) so it is very important to detect these diseases at reversible and early stage to prevent further damage to respiratory system.

Spirometry is the most commonly used tool to assess lung function. Spirometric parameters helps to find out obstructive or restrictive respiratory diseases. Studies have shown that in cigarette smokers, the earliest pulmonary lesion occurs in small airways. The airway in this region of bronchial tree (terminal portion) is not detectable by normal spirometric parameters like FVC, FEV_1 or FEV_1/FVC(4).Thus assessment of maximum mid expiratory flow rate is the specific and sensitive test for early detection of these small airway diseases(3) that specifically reflects small airways obstruction.

AIM AND OBJECTIVE

To determine the effects of tobacco smoking on small airway function by measuring maximum mid expiratory flow rate.

MATERIALS AND METHODS

This was a cross sectional study , conducted at department of physiology in collaboration with Department of General Medicine at Sree Mookambika Institute of Medical Sciences, Kulasekharam, Kanyakumari District, Tamilnadu after obtaining necessary clearance from Institutional Ethics Committee. The study was conducted for a period of 1 year.

Study Population

Sample size was 200 and was based on a study which was published earlier in literature regarding the effects of smoking on pulmonary function tests. In this study, the participants were divided into two groups. Each group had 100 subjects. The detailed description of study groups are given below.

Group I- Asymptomatic smokers, who smoke more than 5 cigarettes per day for more than 1 year.

Group II- Non smokers and not exposed to passive smoking

Inclusion Criteria:

a) Male subjects from rural area of Kanyakumari district
b) Age group:20-40 years
c) Asymptomatic smokers regarding to respiratory complaints
d) Smokers who smoke more than 5 cigarettes per day for more than 1year

Exclusion Criteria:

History of cough or Bronchial asthma
a) History of any acute or chronic respiratory disorders
b) History of any diseases that may directly or indirectly affect the lung functions
c) History of any concurrent tuberculosis or old tuberculosis
d) History of any cardiovascular disease
e) Any anatomical deformities of chest or spine
f) History of any medications
g) Persons not willing to participate in the study

Parameters Studied

Maximum mid expiratory flow rate/ Forced Expiratory Flow ($FEF_{50\%-75\%}$) by pulmonary function test.

Statistical Analysis

The data obtained was entered into the Microsoft Office Excel 2010 for windows. SPSS for windows version 20.0 was used for analyzing data. The results were given as Mean ± Standard deviation. Unpaired 't' test was used to find out the statistical significance between the two group comparisons. One way ANOVA was used for multiple group comparison. The 'p' value of less than 0.001 was considered as statistically significant.

RESULTS

In non-smokers the actual value of $FEF_{25-75\%}$(litres/second) was 4.33 ±0.47 and in smokers the actual value of $FEF_{25-75\%}$ was 2.97 ± 0.50.

There was statistically significant decrease in the level of $FEF_{25-75\%}$ in smokers when compared to non- smokers ($p<0.001$) as shown in Table 1 and Figure 1.

$FEF_{25-75\%}$

The percentage predicted value of $FEF_{25-75\%}$ in smokers with smoking history of 1-5 years found to be 75.4±5.1 The value was 71.9±3.6 in smokers with smoking history of 6-10 years and 68.4±1.8 in smokers with smoking history of 11-15 years. This value was 64.0±4.8 in smokers with smoking history of 16-20 years and 61.2±2.1. in smokers with smoking history of 21- 25 years. From this result we can see that $FEF_{25-27\%}$ decreased with increase in duration of smoking as shown in Table 2 and Figure 2.

Table 1 Comparison Of $FEV_{25-75\%}$ Between Non Smokers And Smokers

Groups	N	Actual Value (L)		% Predicted	
		Range	Mean ± SD	Range	Mean ± SD
Non Smokers	100	3.10 - 5.45	4.33 ± 0.47	81.99-124.19	99.60 ± 9.07
Smokers	100	2.11 - 4.25	2.97 ± 0.50	58.79-83.17	69.00 ± 6.63
Mean Difference		1.36		30.6	
Significance	T	19.79		27.24	
	P	<0.001		<0.001	

All the values expressed as Mean ± SD
Analysis of all parameters done by unpaired t-test
$p<0.001$ is statistically significant

Table 2: Comparison Of $FEF_{25-75\%}$ With Relation To Duration Of Smoking

Duration (yrs)	n	$FEF_{25-75\%}$ (% Pred.)
1-5	24	75.4±5.1
6-10	29	71.9±3.6
11-15	8	68.4±1.8
16-20	24	64.0±4.8
21-25	15	61.2±2.1
ANOVA	F	40.80
	p	<0.001

All the values expressed as Mean ± SD
Analysis of all parameters done by ANOVA
$p<0.001$ is statistically significant

Bar Diagram Showing $Fef_{25-75\%}$ In Non Smokers And Smokers

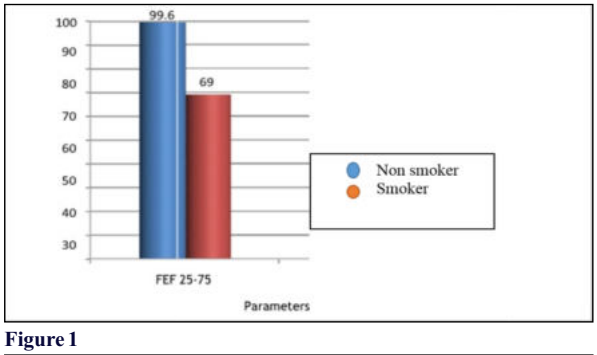

Figure 1

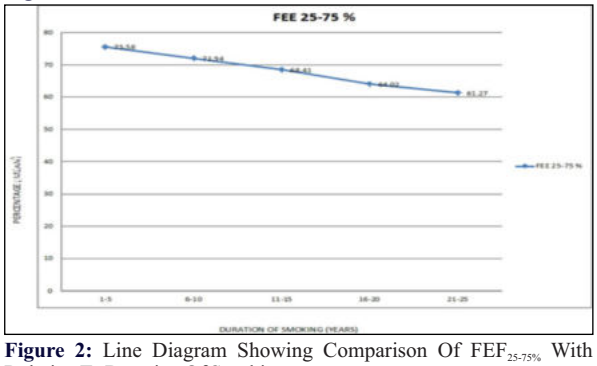

Figure 2: Line Diagram Showing Comparison Of $FEF_{25-75\%}$ With Relation To Duration Of Smoking

DISCUSSION

Cigarette smoking is a major preventable cause of death and chronic disability usually in terms of cardiovascular and respiratory disease all over the world. This study was aimed to study the impact of cigarette smoking on lung functions of a smoker who has not yet developed any respiratory complaints. The study was performed on 200 healthy male subjects of age group 20-40 years. There was one group of 100 asymptomatic smokers and a second group of 100 non-smokers. Maximum mid expiratory flow rate ($FEF_{25-75\%}$) was done in both groups. The mean value was found out and the difference in the mean value between smokers and non smokers were noted.

The maximum mid expiratory flow rate represents the flow rate at middle half of FVC and does not depend on the effort of the person. Maximum mid expiratory flow rate (MMFR) is considered as the most sensitive index in detecting small airway dysfunction. The data in the present study indicate significantly lower values of % predicted MMFR in smokers; suggesting the presence of significant subclinical airflow limitation in smokers .Studies done by Mc Fadden et al(6), Nadeem Ahamed et al(7) and Harkirat Kaur et al(1) showed that there was significant difference in MMFR between smokers and non smokers indicating that the diameter of smaller airways were more affected in smokers.

Characteristic cellular changes in smoking include goblet cell metaplasia and replacement of surfactant secreting clara cells with mucus secreting and infiltrating mononuclear inflammatory cells.. These abnormalities may cause luminal narrowing by excess mucus, edema, and cellular inflammation. Reduced surfactant may cause increase surface tension at the air-tissue interface leading to airway narrowing or collapse. As a result maximum respiratory flow rate decreases.

It was also observed from the study that MMFR decreased more as the duration of smoking increased and as the number of cigarettes smoked per day increased. Similar observations were also made by Nancy N R et al(8) and Tashkin DP et al(9).

Respiratory tract hyper-responsiveness also occurs due to exposure to cigarette smoke and cause decrease in patency of airways which further causes decrease in MMFR. Thus important cause of decrease in MMFR is due to inflammation occurring in the smaller airways which causes the smaller conducting airways to get narrowed and close prematurely leading to bronchoconstriction and hyper-responsiveness of airways.

CONCLUSION

The study showed decrease in $FEF_{25-75\%}$, in smokers compared to non-smokers. The decrease in the values was proportionate with increase in the number of years smoked . This showed a clear dose response relationship. This indicates in smoking the small conducting airways are affected more and there is increased bronchoconstriction and airway hyper-reactivity which may progress to respiratory disorders like asthma and COPD in later stages.

The study provide a glimpse into certain alterations and adaptations in the anatomical structure of lungs, pulmonary functions and the pathophysiology of respiratory diseases occurring due to smoking, even in absence of overt disease. Thus regular screening should be done in smokers to evaluate their pulmonary functions. Also health education on hazards of smoking and banning of smoking in public places has to be encouraged.

REFERENCES

1. Kaur H, Thaman RG, Dhillon SK, Kaur S. Relationship between smoking and pulmonary functions. Nat J Integrated Res Med 2011;2(4):1-6.
2. Prasad DS, Kabir Z, Dash AK, Das BC. Smoking and cardiovascular health. A review of epidemiology,pathogenisis, prevention and control of tobacco. Indian J Med Sci 2009;63(11):520-33.
3. Burgel PR, de Blic J, Chanez P, Delacourt C, Devillier P, Didier A, et al. Update on the roles of distal airways in asthma. Eur Respir Rev 2009;18(112):80-95
4. Kuperman AS, Riker JB. The variable effect of smoking on pulmonary function. Chest J 1973;63(5):655-660.
5. Behera D, Sood P, Singh S. Passive smoking, domestic fuels and lung function in North Indian Children. Indian J Chest Dis Allied Sci 1998;40:89-98.
6. McFadden ER Jr, Linden DA. A reduction in maximum mid expiratory flow rate. A spirographic manifestation of small airway disease. Am J Med 1972; 52(6):725-37
7. Ahmad N, Bano R, Mahagonkar AM, Mishra BN. A comparative study of pulmonary function tests in smokers and nonsmokers in rural Maharashtra. Ind J of Com Health 2010; 22(1):22-5.
8. Nancy NR, Rai UC. A study of forced expiratory spirogram in South Indian beedi smokers and cigarette smokers. Indian J Chest Dis Allied Sci 1983;25:25-30.
9. Detels R, Tashkin DP, Sayre JW, Rokaw SN, Coulson AH, Massey FJ Jr, Wegman DH. The UCLA population studies of chronic obstructive respiratory disease. 9. Lung function changes associated with chronic exposuretophotochemicaloxidants; a cohort study amongnever-smokers. Chest1987;92(4):594-603.