Original Research Article

"IMPACT OF SMOKING CESSATION ON LUNG FUNCTION PARAMETERS – A CROSS SECTIONAL STUDY"

ABSTRACT

Introduction: - There have been widespread adverse effects and association between smoking and tobacco use across published researches, but very few studies have been investigated on the beneficial effects that accompany a long-term cessation of smoking. Comparing the lung function with normal subjects might significantly use the results obtained, if positive, to encourage current smokers to quit smoking and quitters to continue to refrain from smoking. So the purpose of this study was to find out the impact of smoking cessation on lung function parameters when compared among the smokers, quitters, and non-smokers.

Aims: - To determine the impact of cessation of smoking on lung function parameters in quitters as compared to smokers and non-smokers.

Materials and Methods: - The cross sectional observational study was on smokers, non-smokers, and quitters in rural area of Mangalore city. A total of 150 individuals were selected for the study, 50 each from all 3 groups of smokers, non-smokers and quitters using convenient sampling method using convenient sampling process. All participants were examined for Pulmonary Function Test parameters. The analysis was carried out using the Analysis of the variance test to determine the impact of smoking cessation in lung function parameters. The SPSS version used was IBM SPSS 16.0. P value less than 0.05 was considered to be statistically significant.

Results: - significant differences were observed between quitters, smokers and non-smokers in terms of lung function parameters using ANOVA (FVC-p<0.001**, FEV1-p<0.001**, FEV1/FVC-p=0.04** PEFR difference between the groups was not significant with p=0.25). Analysis of PFT parameters using Tukey's multiple post-hoc procedures revealed that FVC and FEV1 showed a significant differences between the quitter group when compared to the smoker group p<0-001**.

Conclusion:- Smoking cessation was followed by substantial change in lung function parameters FVC and FEV1 between the quitters as opposed to the smoker community. Therefore, long-term abstinence can be stressed to be successful in improving functions in quitters comparable to the levels in smokers. Such results should enable health care professionals to explain the cessation of smoking.

Keywords: smokers, nonsmokers, quitters, forced vital capacity and tobacco smoking, copd

Introduction

Tobacco smoking is a major health concern that is responsible for a wide variety of preventable health problems in many regions of the world [1]. Globally, it is estimated that 10 million preventable deaths will occur annually over the next 20 to 30 years, attributable to smoking, of which 70% will occur in developing countries [1]. When considering existing smokers, one in three adults worldwide (1.1 billion people), 80% of who live in middle or low-income countries[1].

India is the third largest producer and consumer of tobacco in the world [2]. Whereas, cigarette consumption is decreasing in developed countries, it is increasing in less-developed countries, such as India. Smoking is responsible for a large number of premature deaths in India [3]. The majority of smoking related deaths in India occur in the prime working age group of 15–59 years [1] Many Indians face serious tobacco-related health problems that affect both their health and productivity. In India there are 120 million smokers approximately. India is home to 12 per cent of smokers worldwide, according to the World Health Organization (WHO). The total number of tobacco users in the world has been estimated at 1.2 billion, which was expected to rise to 1.6 billion by 2020. Tobacco use related deaths approximate 3.5 to 4 million people per year globally with numbers was expected to increase to about 10 million by 2020[4]. There is an immediate need to institute measures to reduce tobacco use in India [5].

Smoking has significant detrimental effects on various systems on the body. Tobacco smoke is a mixture of more than 4000 compounds[5] out of these many compounds are known to be carcinogenic and toxic that cause various pathophysiological effects and is considered as the single most leading modifiable risk factor for developing chronic obstructive pulmonary disease (COPD) ,cardiovascular disease (CVD), and lung cancer[7]. Of all the systems, the pulmonary system is the most affected one due to smoking. It induces airway inflammation and progressive deterioration of lung function. Spirometry for lung health assessment and for screening airflow obstruction is documented [8]. Some authors state that spirometer may be a tool to enhance smoking cessation. Confronting smokers with their abnormal lung function parameters should motivate them to quit [9]. Smoking leads to a rapid decline in pulmonary function tests (PFTs), especially those indicating the diameter of airways, such as forced expiratory flow in one second (FEV1)[8]. The reduction in FEV1 associated with chronic cigarette smoking can be partially explained by the lack of pulmonary elastic recoil force, which limits the force carrying the air out of the lung [10].

Lung function gradually declines with age but smoking can affect the lungs as if they are aging more quickly. A large part of the Government action concentrated on legislation, advertising bans and presentation of unpleasant words and images on cigarette packets [10]. The goal of the anti-smoking legislation is to minimize the consumption of tobacco and create less exposure and a more positive atmosphere for those smokers who wish to quit [10].The success of the community interventions for smoking cessation and changing smoking attitudes is to know the priority of smoking as a public health problem and to make efforts to limit and eradicate smoking [1].However, the full benefits of tobacco treatment may not be realized until many years of abstinence [8].

Smoking cessation is an important goal of most programs for public health. Smoking cessation slows down the accelerated decline in ventilator function; the changes in small airways may disappear completely. If cigarette smokers stop smoking peak expiratory flow rates improve with passage of time [1, 11]. Smokers who have left more than 10-15 years later are likely to do so. After 20 or more years of smoking-induced injury, symptoms are permanent and include emphysematous loss of lung parenchyma, chronic inflammation and obstruction of the pharyngeal airways. Although smoking cessation it does not result in a complete reversal of more severe obstruction, but there can be a substantial reduction of lung function of all smokers who give up.

To date, there is scarcity of information regarding potential benefits of effects of long term cessation of smoking in terms of lung function parameters.

Thus, the aim of this study was to find out the effects of smoking cessation in Lung Function of quitters in comparison with the non-smokers.

Materials and Methods

The cross sectional observational study was on smokers, non-smokers, and quitters in rural area of Mangalore city. A total of 150 individuals were selected for the study, 50 each from all 3 groups of smokers, non-smokers and quitters using convenient sampling method using convenient sampling process. The subjects were selected from the nearby community randomly, according to the selection criteria and were distributed into 3 groups, according to the selection criteria and were distributed into 3 groups; 50 smokers, 50 quitters and 50 non-smokers with the help of statistician, the background of the study was explained to them. Informed consent was obtained from the subjects who were willing to participate in the study and abiding to the instructions and extending their full cooperation. After taking their consent ,who had fulfilled the inclusion criteria of non-smokers and smokers since 5 yrs and above who were with average consumption of more than or equal to 40 packs additional quitters of last 5yrs and smoked at least 10 yrs were included in the study. The demographic data including

age, height (cms), weight (kgs) and other variables such as number of years of smoking, number of years to abstinence, number of pack per year were also recorded(table-1).

Under Selection criteria the Inclusion criteria were 150 healthy adult male age range between 30 to 50 years. Nonsmokers who never smoked, Smokers who are Smoking since last 5 years and above. Packs per year were ≤40, for Quitters who had Quit smoking since 5 years and more and smoked at least for 10 years .Exclusion criteria were any history of established cardiac diseases, Evidence suggestive of respiratory pathology, Haemoptysis of any cause, recent surgery of thorax and abdomen, any history of drug intake like beta blockers, steroid at the time of study. Exclusion criteria for smokers who are quitting on and off, Athletes. And for Quitters those who smoke on and off.

All participants were examined for parameters of the Pulmonary Function Test. According to the American Thoracic Society (ATS), there are a range of measures to be taken prior to the pulmonary function test: follow the list of precautions.- Smoking for at least 1 hour of testing, drinking alcohol for 4 hours of testing, exercising vigorously within 30 minutes of testing, wearing clothing that significantly limits maximum chest and abdominal expansion [9]. Instructions were given to the subjects prior the commencement of the study which included the details about the test to be performed. 2 minutes rest was given prior to the PFT test. The details of the test were explained and demonstrated to each subject; in sitting position subject nose was clipped.

The subjects were instructed about the breathing maneuver, then they were asked to take a deep inspiration and expire as forceful and as fast as possible into the mouthpiece, once the expiration was completed expiratory flow volume curves were recorded by a spirometer (Spiro win version V3.10). FVC, PEFR, FEV1, FEV /FVC ratio were obtained. All subjects were physically healthy, without any symptoms. The total duration for the entire test was 4 to 5 minutes.

STATISTICAL ANALYSIS

The analysis was carried out using the Analysis of the variance test to determine the impact of smoking cessation in lung function parameters.ONE WAY ANOVA has been used to find out the significance in lung function parameters and quality of life of the three groups, and within the group significance was done by Tukeys multiple post hoc procedures. The SPSS version used was IBM SPSS 16.0. P value < 0.05 was considered to be statistically significant.

Results

The study population consisted of 150 male subjects: 50 quitters, 50 smokers and 50 non-smokers. Mean and standard deviation of Demographic Data mentioned. (as seen in Table no. 1)

Table 1: Showing means and standard deviation of Demographic Data

CHARACTER (Mean ± SD)	SMOKERS (n=50)	NON-SMOKERS (n=50)	QUITTERS (n=50)
Age (years)	41.04±5.465	41.5±6.2833	43.2±4.513
Weight (Kg)	60.74±4.13	59.66±2.512	59.4±2.099
Height (cm)	160.2±4.42	157.9±3.66	157.88±2.200
BMI (Kg/cm2)	24.27±1.008	24.085±0.8989	24.2±0.9320
Smoking duration (years)	16.8±7.49	---------	11.7±4.65
Pack/year	11.16±5.69	---------	8.92±3.45

Mean values of FVC in smoker, non-smokers, quitters are 52.89, 61.03, and 63.51 respectively, whereas mean values of FEV1 in smoker, non-smokers, quitters are 61.07, 69.3, and 71.96 respectively. (as seen in Table no.2)

Mean values of FEV1/FVC ratio in smoker, non-smokers, quitters are 121.63, 118.97, and 119.90 respectively, while mean values of PEFR in smoker, non-smokers, quitters are 76.75, 79.01, and 78.51 respectively. (as seen in Table no. 2)

The results of ANOVA, $p<0.001$, indicating there was a significant difference in the lung function parameter i.e. FEV1 among the groups. Similarly, for FVC there was a significant difference $p<0.001$ among the three groups. (as seen Table no. 2) .

The results of ANOVA, $p<0.048$, indicating there was a significant difference in the lung function parameter i.e. FEV1/FVC among the groups but for PEFR there was no significant difference $p<0.25$ among the three groups. (as seen Table no. 2)

So the Inter group comparison of lung function parameters by Tukeys multiple posthoc procedures was performed and the results shown are, FEV1 in Smokers vs. Nonsmokers $P<0.001$**indicating significant difference, Smokers vs. Quitters $P<0.001$** indicating significant

difference, but when Nonsmokers vs. Quitters were compared P<0.061 indicating no significant difference. (as seen Table no. 3)

The Inter group comparison of lung function parameters by Tukeys multiple posthoc procedures results shown are, FVC in Smokers vs. Nonsmokers P<0.001**indicating significant difference, Smokers vs. Quitters P<0.001** indicating significant difference, but when Nonsmokers vs. Quitters were compared P<0.065 indicating no significant difference. (as seen Table no. 4)

The Inter group comparison of lung function parameters by Tukeys multiple posthoc procedures results shown are, FVC in Smokers vs. Nonsmokers P<0.040 indicating no significant difference, Smokers vs. Quitters P<0.253 indicating no significant difference, but when Nonsmokers vs. Quitters were compared P<0.666 indicating no significant difference. (as seen Table no. 4)

Table 2**:** Showing the mean and standard deviation of percentage value of pulmonary function test parameters for 3 groups (smokers, non-smokers and quitters) ANOVA (p<0.05*)

PARAMETERS	SMOKERS	NON-SMOKERS	QUITTERS	PVALUE	F
FVC	52.89±5.58	61.03±5.96	63.51±4.90	p<0.001*	51.064
FEV1	61.07±5.53	69.30±6.59	71.96±5.26	p<0.001*	47.415
FEV1/FVC	121.63±3.04	118.97±8.47	119.90±2.66	P<0.048*	3.096
PEFR	76.75±5.81	79.01±7.55	78.51±7.90	P<0.255	1.383

FVC- Forced vital capacity, FEV1 - Forced expiratory volume during the first second, FEV1/FVC – proportion of person's vital capacity that they are able to expire in first second of forced expiration, PEFR -Peak expiratory flow rate.

Table 3 shows: Inter group comparison of FEV1 by Tukeys multiple posthoc procedures.

Groups	Level of significance*
Smokers Vs. Nonsmokers	P<0.001**
Smokers Vs. Quitters	P<0.001**
Nonsmokers Vs. Quitters	P<0.061

* Statistically significant. **statistically highly significant the mean difference was considered significant at p< 0.05.

Table 4 shows: Inter group comparison of FVC by Tukeys multiple posthoc procedures.

Groups	Level of significance*
Smokers Vs. Nonsmokers	P<0.001**
Smokers Vs. Quitters	P<0.001**
Nonsmokers Vs. Quitters	P<0.065

*p<0.05 statistically significant. **p<0.001 statistically highly significant

Table 5 shows: Inter group comparison of FEV1/FVC by Tukeys multiple posthoc procedures.

Groups	Level of significance*
Smokers Vs. Nonsmokers	P<0.040
Smokers Vs. Quitters	P<0.253
Nonsmokers Vs. Quitters	P<0.666

*p<0.05 statistically significant. **p<0.001 statistically highly significant

FVC- Forced vital capacity,FEV1 - Forced expiratory volume during the first second,FEV1/FVC – proportion of person's vital capacity that they are able to expire in first second of forced expiration ,PEFR -Peak expiratory flow rate.

Discussion

This study was conducted to determine the impact of cessation of smoking on lung function parameters in quitters as compared to smokers and non-smokers 150 males- 50 smokers, 50 non-smokers 50 quitters were selected age matched from the nearby population.

Important observations in this study was made with reference to the three groups post ANOVA test, p<0.001, indicating there was a significant difference in the lung function parameter i.e. FEV1 among the groups. Similarly, for FVC there was a significant difference p <0.001 among the three groups.

The results of ANOVA, p<0.048, indicating there was a significant difference in the lung function parameter i.e. FEV1/FVC among the groups but for PEFR there was no significant difference p <0.25 among the three groups. Our findings implies that quitters when compared with smokers

i.e. FVC p-0.001*, FEV1 p-0.001 * indicate changes. Earlier work in the field by Mallikarjuna Vanagundi et.al in (2014) for 12 weeks smoking cessation in terms lung function concluded that Smoking cessation treatment had significant improvement in lung function and it varied inversely with age and degree of exposure to smoking[4]. A substantial change of lung function is followed by a cessation or significant reduction of smoking. The change differed in reverse with age and level of smoking exposure. FEV1 ($p<0.001$), FVC ($p<0.001$), FEV1 / FVC ($p<0.001$), and PEF ($p<0.001$) in quitters [4]. The lung function parameters may have improved because of decline in airway inflammation and thus improve lung elastic recoil pressure after long term smoking cessation [10,13,14]. Several studies have shown that smoking cessation improves the accelerated decline in forced expiratory volume in one second, which strongly suggests that major inflammatory and/or remodeling processes are influenced positively[15].

Our findings when Inter group comparison of lung function parameters FEV1 in Smokers vs. Nonsmokers P<0.001**indicating significant difference, Smokers vs. Quitters P<0.001** indicating significant difference that is confirming FEV1 values are less in smokers group when compared with both quitters and non-smokers groups. The significant reduction in the flow rates was in consistent with our study also Jetty Jerusha et al concluded FVC, FEV1, PEFR & FVC25-75% are effort dependent and are decreased uniformly in smokers when compared with non-smokers. This suggests smoking effects respiratory system in a significant way. In this study there is decrease in PFT values with increasing age which suggests natural respiratory changes with age. Smokers showed much more lower values as compared to non-smokers which reflect that smoking has a definite bad impact on the natural age related changes of respiratory system [16].

Our findings when Inter group comparison of lung function parameters FVC in Smokers vs. Nonsmokers P<0.001**indicating significant difference, Smokers vs. Quitters P<0.001** indicating significant difference that is confirming FVC values are less in smokers when compared with both quitters and non-smokers groups. The significant reduction in the flow rates was in consistent with the study and brings out substantial variation in most of the parameters of PFTs between smokers and non-smokers confirming PFT values are less in smokers due to toxic effects of tobacco smoking on respiratory system & is the major cause of obstructive lung disease in Indian population [17].

The Inter group comparison of lung function parameters by Tukeys multiple posthoc procedures results shown are, FEV1/FVC in Smokers vs. Nonsmokers P<0.040 indicating no significant difference, Smokers vs. Quitters P<0.253 indicating no significant difference, but when Nonsmokers vs. Quitters were compared P<0.666 indicating no significant difference.

Long term studies ranging from 5- 20 FEV1 in quitters and non-quitters found out that an initial improvement in FEV1 of quitters is followed by decline in FEV1, in both the groups with age but the rate of decline in non-quitters is far more steep while that in quitters is as

experienced by nonsmokers, due to natural aging process[15,18]. A significant proportion of India's population has current or past habit of smoking, with higher prevalence among males than females. Despite the numerous anti-tobacco initiatives, quit-rates have been low. There is a considerable smoking-related respiratory morbidity [19]. Smoking causes detrimental reduction in pulmonary function parameters and thereby affects the normal lung physiology. [13, 15] .

Quitting smoking as soon as possible is important to prevent irreversible damage to the lungs [20].

Limitations

The limitations in the current study design were that the age distribution was unequal and recall bias of start of smoking was not assessed because the subject were unsure about the history.

Conclusion

Smoking cessation is accompanied by a substantial improvement in lung function , i.e. PFT parameters FVC and FEV1 were indicating a significant difference in the quitter group when compared to the smoker group and it is stressed that long-term abstinence is advantageous in such a way that the parameters of lung function may improve as normal as the non-smoking population.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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