Section: Physiology

Original Research Article

COMPARATIVE STUDY OF FEV1 AND PEFR IN SMOKERS AND NON-SMOKERS

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Abstract

Background: Cigarette smoking is a huge public health hazard in every country, but especially in developing countries. The objective is to study and compare FEV1 and PEFR between smokers & non-smokers. To correlate the abnormality in FEV1 and PEFR with the duration of smoking. **Materials and Methods:** It was a Cross-sectional study conducted in the Department of Physiology with allied help from Dept. of Pulmonary Medicine, B.R.D. Medical College, Gorakhpur, after taking written/informed consent from the subjects males aged between 18-45 years for 6 months. Total sample size was 112 cases through non-probability convenience sampling. Spirometric parameters were measured following standard protocols. Various spirometric parameters were done by Portable Spirometer (Model Spirolab IPX1 00155 Roma Italy) in Department of Pulmonary Medicine. SPSS was used for analysis. **Result:** Mean of duration of smoking in 43 cases [4.53±1.47]. Mean FEV1 in cases is [73.26±11.56] and in control group it is [92.03±9.97] {p value<0.0001 statistically significant}. Mean of PEFR in cases and controls. In which mean PEFR in cases is [75.58±16.41] and in control group it is [98.80±14.11] {p value<0.0001 statistically significant}. Correlation of smoking with Spirometric parameters shows negative correlation which was statistically significant. **Conclusion:** Our study it showed a negative correlation between the duration of smoking with spirometric parameters (that is as the duration of smoking increases values of respective parameters decreases) except for FEV1/FVC ratio.

INTRODUCTION

Cigarette smoking is a huge public health hazard in every country, but especially in developing countries. Without quick action, it is anticipated that the number of deaths related to tobacco smoking will climb to 8.3 million by 2030, with the most significant increase occurring in low- and middle-income nations such as China and India.[1]

Tobacco use, in any form, can be considered a behavioural process that generates an addicted state of mind in users on a psychological and physiological level. Nicotine, the primary component of tobacco, is highly addictive, resulting in prolonged tobacco use. According to the 2015 Global Burden of Disease Study,[2] the global prevalence of current males smoking is 25%, with more than half of these males living in three Asian countries—China, India, and Indonesia. While in males smoking prevalence continues to be high, the recent increase in the number of younger and female smokers is a cause for concern.

These cigarettes are meant to deliver high amounts of nicotine to the brain within 10–20 seconds of inhalation by allowing for deep inhalation of smoke from the lungs to the bloodstream.[3] Numerous writers have emphasized that smoking is the single largest risk factor for developing chronic obstructive

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pulmonary disease (COPD). COPD is generally determined by spirometry-based airflow limitation. The degree of airflow blockage can be assessed by calculating the spirometric parameters forced vital capacity (FVC), Forced expiratory volume in one second (FEV1), and FEV1/FVC ratio.[4,5] Although numerous studies have been conducted independently on the parameters, this study might allow the combined and comparative effects of these parameters (i.e. the Spirometric parameters (FEV1 and PEFR) in smokers and non-smokers, particularly in the male population between the ages of 18 and 45 years.

MATERIALS AND METHODS

It was a Cross-sectional study conducted in the Department of Physiology with allied help from Dept. of Pulmonary Medicine, B.R.D. Medical College, Gorakhpur, after taking written/informed consent from the subjects males aged between 18-45 years for 6 months. Total sample size was 112 cases through Non-probability convenience sampling.

Inclusion Criteria

Willing to participate and continue with the study voluntarily. Subjects of age more than 18 and less than 45 of the male gender. Subjects who smoked 10 or more than 10 cigarettes for at least 2 or more than 2 years and upto 7 years. For Controls- Willing to participate and continue with the study voluntarily. Subjects of age more than 18-45 of male gender having no history of smoking.

Exclusion Criteria

Subjects have any medical illness/co-morbidities/any deformity/ neuromuscular disease/handicapped. History of thoracic surgery, or severe heart disease or cancer. Non-willing subjects.

Methodology

The demographic, as well as clinical examination data were noted. The participant were instructed and demonstrated on how to do the technique. All vital signs were recorded, including temperature, pulse, respiration rate, and blood pressure. General and Systemic Examinations were conducted in accordance with established protocols. Spirometric parameters were measured following standard protocols. Various spirometric parameters were done by Portable Spirometer (Model Spirolab IPX1 00155 Roma Italy) in Department of Pulmonary Medicine. Subjects were selected (as per criteria) then taken informed consent, instructed and demonstrated on how to do the technique. FEV1, PEFR as spirometric parameters.

Statistical Analysis

The statistical analysis was performed using SPSS for windows version 22.0 software. The findings were present in number and percentage analyzed by frequency, percent. Chi square test was used to find the association among variables. The critical value of P indicating the probability of significant difference was taken as <0.05 for comparison.

RESULTS

[Table 1] interprets mean of duration of smoking in 43 cases [4.53±1.47]

Table 1: Table for Duration of smoking in Cases

Duration of smoking (dysfunction)	Cases [N=43]	
	N/MEAN	%/SD
MEAN±SD	4.53	1.47
2-4	23	53.49%
5-7	20	46.51%
Grand Total	43	100.00%

Table 2: Table for FEV1 in Case and Control

FEV1	Cases [n=43]		Controls [n=69]		P-value
	N/MEAN	%/SD	MEAN	SD	
MEAN±SD	73.26	11.59	92.03	9.97	t=9.099 p<0.0001*
Normal	10	23.26%	64	92.75%	X=57.08
Abnormal	33	76.74%	5	7.25%	p<0.0001*

[Table 2] is the tabular interpretation of mean of FEV1 in cases and controls. In which mean FEV1 in cases is [73.26±11.56] and in control group it is [92.03±9.97] {p value<0.0001 statistically significant}.

Table 3: Table for FEV1/FVC in Case and Control

FEV1/FVC	Cases [N=43]		Controls [N=69]		P-value
	N/MEAN	%/SD	N/MEAN	%/SD	
MEAN±SD	102.65	13.91	97.29	9.56	t=2.416 p=0.0173*
Normal	34	79.07%	41	59.42%	X=4.624
Abnormal	9	20.93%	28	40.58%	p=0.0315*

[Table 3] is the tabular interpretation of mean of FEV1/FVC in cases and controls. In which mean FEV1/FVC in cases is [102.65±13.91] and in control group it is [97.26±9.56] {p value=0.0173 statistically significant}

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Table 4: Table for PEFR in Case and Control

PEFR	Cases [n=43]		Controls [n=69]		P-value
	MEAN	SD	MEAN	SD	
MEAN±SD	75.58	16.41	98.80	14.11	t=7.952 p<0.0001*

[Table 4] is the tabular interpretation of mean of PEFR in cases and controls. In which mean PEFR in cases is [75.58±16.41] and in control group it is [98.80±14.11] {p value<0.0001 statistically significant}

Table 5: Correlation Between Smoking and FEV1, PEFR

	Spearman r	95% confidence interval	P value
Smoking Vs. FEV1	-0.6371	-0.7383 to -0.5080	<0.0001*
SmokingVs.FEV1/FVC	0.2694	0.08271 to 0.4378	0.0041*
Smoking Vs. PEFR	-0.6121	-0.7190 to -0.4770	<0.0001*

[Table 5] denotes relation of smoking with Spirometric parameters shows negative correlation which statistically significant.

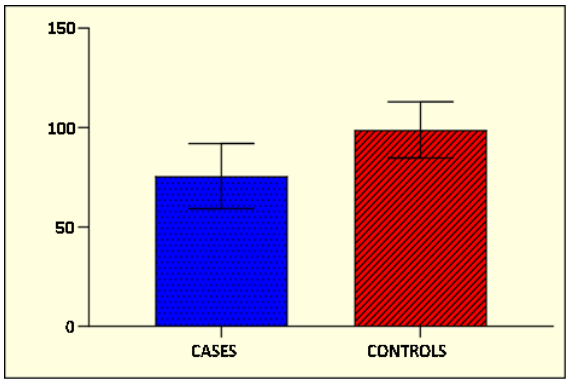

Figure 1: Figure for mean of PEFR in Cases and Controls

[Figure 1] is the graphical representation of mean of PEFR in cases [75.58±16.41] with controls [98.80±14.11]

DISCUSSION

Cigarette smoking severely threatens global public health, particularly in developing nations. Despite the fact that the prevalence of smoking has decreased in many countries as a result of improved awareness of its dangers and tobacco control policies, smoking continues to expand globally.[1]

Many researchers found that smoking is the largest risk factor for chronic obstructive pulmonary disease (COPD).[6,7] Typically measured by spirometry based airflow limitation. By measuring the spirometry parameters such as forced vital capacity (FVC), Forced expiratory volume in one second (FEV1), and FEV1/FVC ratio, the degree of airflow obstruction can be assessed.[8-10]

In this study, the mean value of the duration of Smoking was observed [4.53±1.47] among the case group. The patient in the case group who smoked for 2-4 years have the mean value [23(53.49%)], and the patients who smoked for 5-7 years have mean [20(46.51%)].

The mean value of the Forced Expiratory Volume at the end of 1 second (FEV1) was higher in the control [92.03±9.97] as compared to the case [73.26±11.59] group. The majority of the subjects in the control group (64) were having normal range of FEV1, compared to the case group (33). The duration of smoking showed a negative correlation with FEV1 which means as the duration of smoking increases the value of FEV1 decreases which is statistically significant [p<0.0001*; r=-0.6371].

The mean value of the Tiffeneau-Pinelli index (FEV1/FVC) was higher in cases [102.65±13.91] than in the control group [97.29±9.56]. The majority of the subjects were normal in both cases (34) and the control group (41). The smoking showed a positive correlation with FEV1/FVC [p=0.0041*; r=0.2694].

The mean value of the Peak Expiratory Flow Rate (PEFR) was higher in the control [98.80±14.11] compared to the case group [75.58±16.41]. A significant negative correlation was observed between smoking and PEFR [p<0.0001*; r=-0.6121].

The mean value of the Forced Expiratory Flow At 25-75% (FEF 25-75%) of the pulmonary volume was higher in the control [89.20±12.00] than in the case group [83.58±21.62]. A negative correlation was observed between smoking and FEF 25-75% [p=0.0143*; r=-0.2309].

Supporting our study Baburdikar R et al,[11] observed a significant difference in all the spirometry parameters among both groups. Likewise, Vyas H et al,[12] observed the mean difference in values for the pulmonary function test for FEV1 was highly significant, while for FEV1/ FVC ratio, the differences were not statistically significant between smokers and non- smokers groups. Compared to non-smokers, smoking negatively affected lung functions, with smokers exhibiting a significantly larger percentage fall in FVC, FEV1, Ratio of FEV1/FVC, FEF 25-75%, and PEFR.As result this smoking causes deterioration in lung functions which leads to alteration in spirometric parameters over a period of time which finally causes respiratory illnesses like COPD, emphysema and cancers.[13-15] Our study had various limitations like short monitoring time and single institute nature which became the main drawbacks, which may not be generalized for all settings. Hence, it cannot be incorporated into the larger population and more longitudinal studies in different

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geographical regions are needed. Along with that majority of subjects in our study were overweight, which may have altered the evaluation of the lipid profile of the subjects.

CONCLUSION

The mean value of the FEV1, FVC, PEFR, FEF 25-75% was observed higher in the control group in comparison with the cases whereas the Tiffeneau-Pinelli index (FEV1/FVC) was higher in cases in comparison to the controls. However, some supported our observations, and a few were against them. To conclude, our study it showed a negative correlation between the duration of smoking with spirometric parameters (that is as the duration of smoking increases values of respective parameters decreases) except for FEV1/FVC ratio. Compared to non-smokers, smoking negatively affected lung functions, with smokers exhibiting a significantly larger percentage fall in FVC, FEV1, Ratio of FEV1/FVC, FEF 25-75%, and PEFR.As a result this smoking causes deterioration in lung functions which leads to alteration in spirometric parameters over a period of time which finally causes respiratory illnessess like COPD, emphysema and cancers. Thus a larger study assessing similar issues and bypassing the con- founders, multicentric studies with a comparatively higher sample size may be required.

REFERENCES

1. Shafey O, Dolwick S, Guindon GE, editors. Tobacco Control Country Profiles. Atlanta, GA: American Cancer Society; 2003.
2. GBD 2015 Tobacco Collaborators. Smoking prevalence and attributable disease burden in 195 countries and territories, 1990-2015: a systematic analysis from the Global Burden of Disease Study 2015. Lancet. 2017;389 (10082):1885-1906.
3. Benowitz, N.L.; Hukkanen, J.; Jacob, P. Nicotine chemistry, metabolism, kinetics and biomarkers. Handb. Exp. Pharmacol. 2009, 192, 29–60.
4. Dutt S, Gogia T, Gupta M. A comparative study on pulmonary function tests in smokers & nonsmokers. Indian J Clin Anat Physiol 2021;8(1):53-56.
5. Kelly T, Yang W, Chen CS, Reynolds K, He J (2008) Global burden of obesity in 2005 and projections to 2030. Int J Obes (Lond); 32(9):1431–7.
6. U.S. Department of Health and Human Services. The Health Consequences of Smoking—50 Years of Progress: A Report of the Surgeon General; Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking andHealth: Atlanta, GA, USA, 2014; pp. 1–36.
7. US Department of Health and Human Services. How tobacco smoke causes disease: the biology and behavioral basis for smoking-attributable disease. A report of the US Surgeon General, Atlanta, Georgia: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2010. Available from: https://www.ncbi.nlm.nih.gov/books/NBK53017/.
8. Churg A, Cosio M, and Wright JL. Mechanisms of cigarette smoke-induced COPD: insights from animal models. American Journal of Physiology. Lung Cellular and Molecular Physiology, 2008; 294(4):L612-31. Available from: https://www.ncbi.nlm.nih.gov/pubmed/18223159
9. Global Initiative for Chronic Obstructive Pulmonary Disease. Global strategy for the diagnosis, management, and prevention of chronic obstrictove pulmonary disease. 2018 report. 2018. Available from: https://goldcopd.org/wp- content/uploads/2017/11/GOLD-2018-v6.0-FINAL-revised-20-Nov_WMS.pdf
10. Kim V and Criner GJ. Chronic bronchitis and chronic obstructive pulmonary disease. American Journal of Respiratory and Critical Care Medicine, 2013; 187(3):228-37. Available from: https://www.ncbi.nlm.nih.gov/pubmed/23204254
11. Nayak M, Dodiya D, Nayak J. Assessment of LIPID PROFILE in smokers versus non-smokers. Int J Res Med. 2016;5(2):26-9.
12. Baburdikar RS, Khake SA. A cross-sectional study of spirometry parameters in smokers, non-smokers, and ex-smokers in software engineers of an it company in the western part of Maharashtra. International Journal of Health Sciences.(II):10924- 30.
13. Vyas HP, Vinchhi RP, Sheth MS, Vyas NJ. Comparison of pulmonary function among smokers and non-smokers–A retrospective study. Age (years). 2014;56(14.29):51-48.
14. Nighute S, Awari A. Study of pulmonary function test in smoker and non-smoker in rural area of Gujarat. Journal of Clinical and Diagnostic Research. 2011;5:1151-3.
15. Dhand R, Malik SK Sharma PK. Long term effects of tobacco smoking: Results of spirometric study in 300 old men. Indian J Chest Dis Allied Sci 1985;27:44-9.

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