How to Cite:
Baburdikar, R. S., & Khake, S. A. (2022). 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*, *6*(S2), 10924–10930. https://doi.org/10.53730/ijhs.v6nS2.7935

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

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***Abstract*---**Background: Smoking causes deterioration in lung functions and spirometry can be helpful to diagnose it early. Smoking is a major risk factor associated with the development of COPD which can be prevented by cessation of smoking. The purpose of the study was to know, whether there was any difference in the spirometry parameters in smokers, ex-smokers, and non-smokers. Objective: To Compare spirometric parameters i.e FEV1, FVC, FEV1/FVC ratio, and PEFR in smokers, non-smokers & ex-smokers.Methods: An observational, cross-sectional study was conducted on 322 Software Engineers. Institutional ethics committee approval was obtained before the study. Spirometry (Computerized Spirometer Helios 401) or recording lung parameters was done on individuals who were willing to participate and met the inclusion criteria. Results: Our study showed that the spirometry parameters FEV1, FVC & FEV1/FVC ratio was lower in smokers as compared to non-smokers & ex-smokers. There was significant difference in spirometry parameters in the three groups FVC ($p < 0.001$), FEV1 ($p < 0.001$), FEV1/FVC ($p < 0.001$), FEF25-75 ($p < 0.01$) and PEFR ($p < 0.01$). Conclusion: The present study showed spirometry parameters in smokers were significantly lower than in non-smokers.

***Keywords*---**FEV1, FVC, FEV1/FVC, PEFR, smokers, non-smokers, ex-smokers.

Introduction

Cigarette smoking is a complex social and medical issue. In 2010, WHO estimated that about 24% of men and about 3% of women smoked in India[1]. Cigarette smoke contains more than 6000 compounds of which more than 2000 potentially noxious constituents are present in tobacco smoke. Smoking is a major risk factor associated with the development of COPD, Chronic bronchitis, and lung cancer through a myriad of mechanisms [2].

Smoking has negative health effects because smoke inhalation inherently poses challenges to various physiological processes such as respiration and it has extensive deleterious effects on respiratory functions [3]. Smoking is a major risk factor for developing COPD. It can be prevented by the cessation of smoking. It is important to diagnose COPD early by carrying out Pulmonary Function Tests in smokers, as smoking cause deterioration in lung function[4]. The pathophysiological mechanisms that affect the airways involve inflammation, altered cell growth, cellular apoptosis, abnormal cell repair, oxidative stress, etc. leading to symptoms of cough with or without phlegm.[3] COPD due to smoking can be prevented by cessation of smoking. It is important to diagnose COPD early by carrying out Pulmonary Function Tests in smokers, as smoking cause deterioration in lung function[4]. Spirometry is a simple test to detect COPD before symptoms develop.

Spirometry assessments are a vital part of monitoring lung functions, which in combination with early management of affected subjects can prevent long-term pulmonary conditions and halt the disease progression. Early assessment with spirometry can also prevent the development of life-threatening conditions in smokers and subjects with lung diseases. However, the data assessing spirometry parameters in subjects of IT companies are scarce in the literature. The main purpose of the study was to compare the spirometry parameters in the healthy Software Engineers who were smokers, non-smokers, and ex-smokers. to spread awareness among them about the hazards of smoking on the lungs and to encourage smokers to quit smoking.

Materials and Methods

The present observational, cross-sectional study was conducted by Engineers of a Software company in the Western part of Maharashtra, India. Institutional ethics committee approval was obtained prior before starting the study. Flyer regarding the spirometry test and study to be carried out was shared with all the IT professionals in the company. Those who were willing to participate in the study filled out the google form which included, demographic details, medical history, and a self-structured pre-validated questionnaire that included details about smoking habits like smoking status, duration of smoking, and number of cigarettes smoked per day.

Questions regarding exposure to passive smoking, and exposure to indoor or outdoor pollution were also asked. 413 participants registered by filling out the google form. Healthy asymptomatic individuals of Age: 25-50 years old, Males who gave consent to participate in the study were included in the study. Those with a

history of respiratory illness like bronchial asthma, COPD, pneumonia, tuberculosis, and cardiovascular disease, or a history of congenital heart disease chest or spinal deformity obesity (BMI>32 kg/m^2), and Individuals having Diabetes mellitus were excluded from the study. Individuals with a history of any recent eye surgery and a history of any abdominal or thoracic surgery were also excluded from the study. Thus, 322 individuals were included in the study.

Participant information sheet regarding the study purpose and procedure for spirometry with instructions to be followed by the participants before the spirometry test was given. Written consent was obtained. The tests were carried out by giving prior appointments. Day and date slots were decided for each individual who reported on the said date and time. The data collection was done for 3 days. On reporting for the test brief medical history was sought again. Height and weight were recorded, Blood pressure was measured and a spirometry test is done. Spirometry (Computerized Spirometer Helios 401) was carried out. The spirometry procedure was well explained to all the participants.

Two trials were given to each participant and for each test 3 test runs with best of three test readings were done taken. Tests were done in the post-absorptive phase. A disposable mouthpiece was used for each participant. The study was carried out for 3 days with calibration of the instrument each day was done. Depending on the smoking status the participants were later grouped as Smokers, Non-smokers, and Ex-smokers (Criteria as suggested by WHO 1988)[5] Smokers: smoking for any duration and Occasional smoker, Ex-smokers: quit smoking minimum of one year before the study, and Non-smokers: Who has not smoked at all. The data collected was analyzed statistically and were expressed in mean and standard deviation.

Results

For all the 323 participants in the study mean age was 34.40±5.1, and anthropometric parameters were, height 170.73±7.1, weight 73.50± 11.2, and BMI 25.22±3.6 as shown in Table I. Table I also shows the mean Age and the Anthropometric parameters in the three groups i.e smokers, non-smokers and ex-smokers. There was no significant difference seen for age and anthropometric parameters between the three groups. The smoking duration of 1-5 years was reported in 48.56% of study subjects, 6-10 years in26.30% of subjects, 11-15 years in 4.5% of study subjects, 16-20 in 2.2% of study subjects, and >20 years in 6.7% study subjects respectively as shown in Table 1.

The results showed that there was significant difference in the mean spirometry parameters in three groups FVC ($p < 0.001$), FEV1 ($p < 0.001$), FEV1/FVC ($p < 0.001$), FEF25-75 ($p < 0.01$) and PEFR ($p< 0.01$) seen in the three groups as shown in Table 2. Multiple comparisons of spirometry parameters in smokers, non-smokers and ex-smokers showed that there was significant difference found in spirometry parameters between smokers and non-smokers FVC ($p < 0.001$), FEV1 ($p < 0.001$), FEV1/FVC ($p < 0.001$), FEF25-75 ($p < 0.01$) and PEFR ($p< 0.01$) as shown in Table 3.

Discussion

There was deterioration in lung functions in smokers as compared to non-smokers and ex-smokers. Our findings are consistent with the other studies carried out by, Sreenivas Bs et al,[5] Vyas HP et al[6], and Patel MM et al [7]. There was no significant difference found in Spirometry parameters between ex-smokers and non-smokers. In the present study, the mean age of the study subjects was 34.40±5.1, and anthropometric parameters were, height 170.73±7.1, weight 73.50± 11.2, and BMI 25.22±3.6 as shown in Table I. Table I also shows the mean Age and the Anthropometric parameters in the three groups i.e smokers, non-smokers, and ex-smokers. There was no significant difference seen for age and anthropometric parameters between the three groups. The smoking duration of 1-5 years was reported in 48.56% of study subjects, 6-10 years in26.30% of subjects, 11-15 years in 4.5% of study subjects, 16-20 in 2.2% of study subjects, and >20 years in 6.7% study subjects respectively. These demographics were comparable to the studies of Holmen TL et al in 2002 and Powell R et al in 2013 where authors assessed subjects with demographics comparable to the present study.

The study results also showed that there was significant difference in the mean spirometry parameters in three groups FVC ($p < 0.001$), FEV1 ($p < 0.001$), FEV1/FVC ($p < 0.001$), FEF25-75 ($p < 0.01$) and PEFR ($p< 0.01$) seen in the three groups. These results were consistent with the previous findings of Urrutia I et al in 2005 and Evans JA et al in 2009 where authors reported a statistically significant difference in the spirometry parameters of smokers, non-smokers, and ex-smokers which was similar to the findings of the present study. Concerning the multiple comparisons of spirometry parameters in smokers, non-smokers and ex-smokers showed that there was significant difference found in spirometry parameters between smokers and non-smokers FVC ($p < 0.001$), FEV1 ($p < 0.001$), FEV1/FVC ($p < 0.001$), FEF25-75 ($p < 0.01$) and PEFR ($p< 0.01$). These results were in agreement with the studies of Kenfield SA et al in 2010 and Harvey BG et al in 2015 wherein smokers and non-smokers, a significant difference was seen in the spirometry parameters.

Conclusion

Thus, smoking cessation may reverse and prevent further deterioration in lung health. Computerized Spirometry can be a useful tool for screening smokers and monitoring and detecting early changes in lung functions. The limitations of the present study were smaller sample size, short monitoring time, and single institute nature. Hence, more longitudinal studies in different geographical regions are needed.

Type of study: Original Research Paper
Conflicts of interest: Nil

References

1. WHO global report on trends in the prevalence of tobacco smoking 2015.

2. Stanescu D, Sanna A, Veriter C, et al. Airway obstruction, chronic expectoration, and rapid decline of FEV1 in smokers are associated with increased levels of sputum neutrophils.Thorax1996;51:267-271.
3. Fishmaman's Pulmonary Disease and Disorders.volume-1.pg699,705.
4. Wright JL, Lawson LM, Pare PD, Wiggs BJ, Kennedy S Hogg, JC. Morphology of peripheral airways in current smokers and ex-smokers. Am Rev Respir Dis 1983;127.474-7.
5. Sreenivas BS, Sunitha MS, Nataraj SM, Dhar M. A study of the deterioration of pulmonary function parameters among smokers and recovery among ex-smokers in bus depot workers. Indian J Physiol Pharmacol. 2012;56:154-60.
6. Vyas HP, Vinchhi RP, Sheth MS, Vyas NJ. Comparison of pulmonary function among smokers and non-smokers-a retrospective study. Int J Med Sci Public Health. 2014;3:1232-4.
7. Patel MM, Sisodia JA, Shah NT. A comparative study of spirometry in healthy smokers and healthy non-smokers. Int J Res Med. 2014;3;68-70.
8. Holmen TL, Barrett-Connor E, Clausen J, et al. Physical exercise, sports, and lung function in smoking versus nonsmoking adolescents. *Eur Respir J* 2002;19:8–15.
9. Powell R, Davidson D, Divers J, et al. Genetic ancestry and the relationship of cigarette smoking to lung function and percent emphysema in four race/ethnic groups: a cross-sectional study. *Thorax* 2013;68:634–42.
10. Urrutia I, Capelastegui A, et al.: Smoking habit, respiratory symptoms and lung function in young adults. *Eur J Public Health*, 2005;15:160–5.
11. Evans JA, Whitelaw WA: The assessment of maximal respiratory mouth pressures in adults. *Respir Care*, 2009;54:1348–59.
12. Kenfield SA, Wei EK, Rosner BA, et al.: Burden of smoking on cause-specific mortality: application to the nurses' health study. *Tob Control*, 2010;19:248–54.
13. Harvey B-G, Strulovici-Barel Y, Kaner RJ, et al. Risk of COPD with obstruction in active smokers with normal spirometry and reduced diffusion capacity. Eur Respir J 2015;46:1589-97.

Tables

Variable		N	Mean	Std. Deviation
AGE yrs	Smoker	83	34.80	4.534
	Non-smoker	173	34.25	3.560
	Ex-smoker	67	35.48	4.328
	Total	323	34.40	5.114
HEIGHT cm	Smoker	83	169.75	7.802
	Non-smoker	173	171.02	7.457
	Ex-smoker	67	171.21	4.922
	Total	323	170.73	7.107
WEIGHT kgs	Smoker	83	72.19	10.284
	Non-smoker	173	73.38	10.003
	Ex-smoker	67	75.40	14.665
	Total	323	73.50	11.210
BMI	Smoker	83	25.0162	2.85064

	Non-smoker	173	25.1148	3.31707
	Ex-smoker	67	25.7799	5.22330
	Total	323	25.2274	3.69063

Table 1: Demographic assessment for Age, Height, Weight and BMI in study subjects

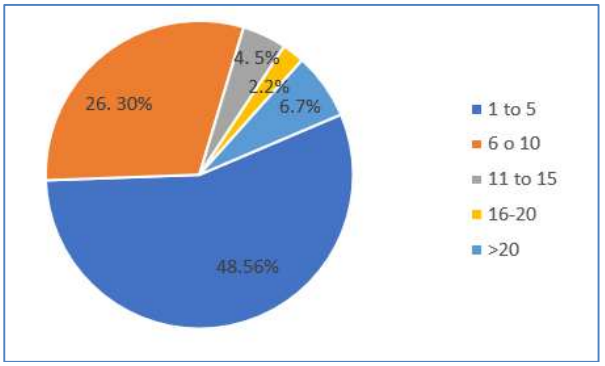

Figure 1: Smoking duration in the study subjects

Spirometer parameters	Subgroups	Sum of square	df	Mean square	f	Significance
FEV1	Between Groups	6.312	2	3.156	9.830	.000
	Within Groups	102.737	320	.321		
	Total	109.049	322			
FVC	Between Groups	7.127	2	3.563	12.371	.000
	Within Groups	92.180	320	.288		
	Total	99.307	322			
FEV1/FVC RATIO	Between Groups	3588.599	2	1794.300	68.850	.000
	Within Groups	8339.468	320	26.061		
	Total	11928.068	322			
FEF25-75	Between Groups	565.453	2	282.726	66.080	.000
	Within Groups	1369.139	320	4.279		
	Total	1934.592	322			
PEFR	Between Groups	634940.028	2	317470.014	14.990	.000
	Within Groups	6734951.413	318	21179.092		
	Total	7369891.440	320			

Table 2: Spirometry parameters in three groups of study subjects

Dependent Variable	(I) smokers status	(J) smokers status	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
FEV1	Smoker	Non-smoker	-.33542*	.06267	.000	-.4861	-.1848
		Ex-smoker	-.22167*	.07343	.009	-.3997	-.0436
	Non smoker	Smoker	.33542*	.06267	.000	.1848	.4861
		Ex smoker	.11375	.08090	.411	-.0816	.3091

	Ex smoker	Smoker	.22167*	.07343	.009	.0436	.3997
		Non-smoker	-.11375	.08090	.411	-.3091	.0816
FVC	Smoker	Non smoker	.31829*	.06096	.000	.1716	.4650
		Ex smoker	.05016	.09069	.927	-.1698	.2702
	Non-smoker	Smoker	-.31829*	.06096	.000	-.4650	-.1716
		Ex-smoker	-.26813*	.08911	.010	-.4844	-.0519
	Ex-smoker	Smoker	-.05016	.09069	.927	-.2702	.1698
		Non-smoker	.26813*	.08911	.010	.0519	.4844
FEV1/FVC RATIO	Smoker	Non-smoker	-6.52333*	.51066	.000	-7.7512	-5.2954
		Ex-smoker	-9.16556*	.68296	.000	-10.8297	-7.5014
	Non-smoker	Smoker	6.52333*	.51066	.000	5.2954	7.7512
		Ex-smoker	-2.64224*	.78668	.003	-4.5441	-.7404
	Ex-smoker	Smoker	9.16556*	.68296	.000	7.5014	10.8297
		Non-smoker	2.64224*	.78668	.003	.7404	4.5441
FEF25-75	Smoker	Non-smoker	-2.81134*	.20926	.000	-3.3155	-2.3072
		Ex-smoker	-3.41645*	.16264	.000	-3.8135	-3.0194
	Non-smoker	Smoker	2.81134*	.20926	.000	2.3072	3.3155
		Ex-smoker	-.60512	.25793	.058	-1.2255	.0153
	Ex-smoker	Smoker	3.41645*	.16264	.000	3.0194	3.8135
		Non-smoker	.60512	.25793	.058	-.0153	1.2255
PEFR	Smoker	Non-smoker	-87.28970*	15.22116	.000	-123.995	-50.5840
		Ex-smoker	4.04813*	.16935	.000	3.6378	4.4585
	Non-smoker	Smoker	87.28970*	15.22116	.000	50.5840	123.995
		Ex-smoker	91.33783*	15.22156	.000	54.6312	128.044
	Ex-smoker	Smoker	-4.04813*	.16935	.000	-4.4585	-3.6378
		Non-smoker	-91.33783*	15.22156	.000	-128.044	-54.6312

Table 3: Multiple comparisons of spirometry parameters in smokers, non-smokers, and ex-smokers