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A comparative study of pulmonary function between smokers and nonsmokers of rural population of Katihar, Bihar, India

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ABSTRACT

Background: In India, where majority of the population lives by agriculture and linked occupations in rural areas despite of rapid increase in urban population, the pulmonary function is expected to vary between smokers and non-smokers.

Methods: This study was carried out in the rural population of Katihar, Bihar in 100 participants. Prior consent was obtained from the Ethical committee for the study. Computerized spirometer RMS Helios 701 was used for the study. **Results:** This study was done for a better understanding of effects of smoking in the rural population of Katihar. In rural non-smokers, the observed value of pulmonary functions in mean±standard deviation, FVC was 3.28±1.04 litres, FEV1 was 2.72±0.97 litres, FEV1% was 85.24±28.24, PEFR was 7.8±1.98 litres/minute, FEF25-75% was 4.28±0.99 litres. The observed value of pulmonary functions in rural smoker population in mean±standard deviation, FVC was 2.56±0.86 litres, FEV1 was 2.21±0.96 litres, FEV1% was 86.00±23.73, PEFR was 5.65±2.18 litres/minute, FEF25-75% was 3.34±1.37 litres.

Conclusions: The comparative study of pulmonary function between rural smokers and rural non-smokers showed significant decreased value (p value < 0.05) in smokers of rural population.

Keywords: Non-smokers, Pulmonary Function Test, Rural, Smokers

INTRODUCTION

As per the 'WHO' report on the global tobacco epidemic, 2015, tobacco use is the largest preventable risk factor for non-communicable diseases. Tobacco is the biggest external cause of non-communicable disease and is responsible for more deaths than adiposity, both in high income countries and globally. There were about 100 million deaths from tobacco in the 20th century, mostly in developed countries. If current smoking patterns persist, tobacco will kill about 1 billion people this century, mostly in low- and middle-income countries. About half of these deaths will occur before 70 years of age. Smoking is well-known to cause respiratory disorders and pulmonary functions decline and when it

co-exists with air pollution, the effects could be more harmful.⁵ Tobacco smoking is widely prevalent all over the world and it continues to rise in developing countries. By 2030 the developing world is expected to have 7 million deaths annually from tobacco use. Smokers have higher prevalence of lung function abnormalities and respiratory symptoms and higher death rates as compared to non-smokers. In India, where majority of the population lives by agriculture and linked occupations in rural areas, the pulmonary function is expected to vary between smokers and non-smokers in rural population. In a study the prevalence of COPD from four different parts of India was seen as 4.1% with a male to female ratio of 1.56:1 and a smoker to non-smoker ratio of 2.65:1.⁶ In another study, lower value of FVC, FEV₁ and MEFR

(FEF_{25-75%}) was seen in smokers as compared to non-smokers.⁷ A dose response relationship was found between smoking and lower levels of FEV₁ /FVC and FEF _{25-75%}. Smoking 15 cigarettes or more per day, as compared with never smoking was associated with a reduction in FEF_{25-75%}.⁸ Smokers are not only the cause of health problems for themselves, but also by producing environmental tobacco smoke, they impose dangers for others. Environmental tobacco smoke constitutes a common problem in many countries. In rural population of India, it is very common for the adults to gather in groups, where so many persons smoke and those who are non-smokers are exposed to passive environmental tobacco smoke.

In a study, the lung volumes and capacities of active smokers and passive smokers both were significantly lower than non-smokers.9 Results showed a lower vital capacity (VC), tidal volume (TV), expiratory reserve volume (ERV) and maximum ventilatory volume (MVV) in both active and passive smokers as compared to nonsmokers. Pulmonary function test is a valuable tool for evaluation and assessment of the respiratory system. Spirometry is the stand alone test that can identify substantial number of subjects with lung abnormalities, without exposing them to radiation or other expensive methods. It is useful for identifying both type of patients, patients with expiratory airflow limitations and patients with reduced lung volumes i.e. both obstructive and restrictive pattern can be identified. 10 Another commonly used method to assess pulmonary function is questionnaires, but the reliability of this method is limited.¹¹ There are various applications of Spirometry like evaluation of symptoms (chest pain, cough, dyspnoea, wheezing), evaluation of signs (cyanosis, chest deformity, crackles), to screen persons at risk for pulmonary diseases (smokers, hazardous jobs), to perform routine physical examination, to assess for disability impairment, to assess for rehabilitation programs, to assess therapeutic effects (bronchodilator therapy, steroid treatment), to do epidemiological surveys and research works, for legal purposes (compensation lawsuits).

Recently pulmonary function testing has been shown to influence the attitude towards smoking. Performing spirometry changes the attitude towards smoking for a short time. A study in 513 smokers with a follow up of 3 months, showed increased prevalence of quitters in smokers after spirometry test. 12

METHODS

This study of was carried out in the Department of Physiology, Katihar Medical College, and rural population of nearby villages. Prior consent was obtained from the Ethical committee. Informed consent was taken from the study participants before performing the pulmonary function tests. For this study, computerized spirometer, RMS Helios 701 with a flow range of ± 14

liters per second, with overall accuracy of $\pm 1\%$ (using a standard 3 liters calibration syringe) was used. The sample consisted of 100 healthy male adults from rural areas of Katihar, Bihar. Out of the total sample 50 smokers and 50 non-smokers subjects were selected for the study. The time chosen for performing the spirometry test was day time between 11.00 A.M to 2.00 P.M. to avoid diurnal variations.

Exclusion criteria

- Those subjects who did not give consent
- Recent myocardial infarction less than one month old
- Asthma and COPD subjects
- Chronic infections such as tuberculosis or other infections of lungs
- Subjects with respiratory symptoms such as cough
- Hemoptysis of unknown origin (forced expiratory maneuver may aggravate the underlying condition).
- Pneumothorax
- Thoracic, abdominal, or cerebral aneurysms
- Recent eye surgery (e.g. cataract)
- Presence of an acute disease process that might interfere with test performance (e.g. nausea, vomiting)
- Previous accidents or surgery involving thorax or abdomen.

A detailed history taking and general examination was done to rule out exclusion criteria. Before performing pulmonary function test, following points were ascertained that the,

- Subject has not consumed alcohol within four hours
- Has not smoked within one hour
- Has worn comfortable clothing, not restricting chest and abdominal movements
- Has not performed vigorous exercise within half an hour.

Statistical analysis

The data is expressed in mean±SD, standard error of difference between two means, 'z' value and 'p' value. Comparison between the two groups was done using the "z" test, taking 'p' value <0.05 as significant.

RESULTS

The observations and results are presented in tables and clustered pyramids. Pulmonary Function Test (PFT) results in smoker and nonsmokers of rural population of Katihar, Bihar.

Table 1 shows PFT results in rural nonsmoker males in mean \pm standard deviation. FVC was 3.28 \pm 1.04 litres, FEV1 was 2.21 \pm 0.96 litres, FEV1% was 86.00 \pm 23.73, PEFR was 7.80 \pm 1.98 litres and FEF25-75% was 4.28 \pm 0.99.

Table 1: PFT results in rural nonsmoker population.

PFT results in rural nonsmokers (male) (n=50)						
Parameters	Mean	Standard deviation (SD)				
FVC (in litres)	3.28	1.04				
FEV ₁ (in litres 1sec)	2.72	0.97				
FEV _{1%} (percentage)	85.24	28.24				
PEFR (in litres/min)	7.8	1.98				
FEF _{25-75%} (in litres)	4.28	0.99				

Table 2 shows PFT results in rural smoker males in mean ±standard deviation. FVC was 2.56±0.86 litres, FEV1 was 2.72±0.97 litres, FEV1% was 85.24±28.24, PEFR was 5.65±2.18 litres and FEF25-75% was 3.34±1.37.

Table 2: PFT results in rural smoker population.

PFT results in rural smokers (male) (n=50)						
Parameters	Mean	Standard deviation (SD)				
FVC (in litres)	2.56	0.86				
FEV ₁ (in litres 1sec)	2.21	0.96				
FEV _{1%} (percentage)	86.00	23.73				
PEFR (in litres/min)	5.65	2.18				
FEF _{25-75%} (in litres)	3.34	1.37				

Table 3 shows comparison of PFT results in rural nonsmoker and smoker population showing significance with 'p' value < 0.05.

Table 3: Comparison of PFT in rural non-smokers male (RNSM) and rural smokers male (RSM).

PFT	RNSM mean±sd n=50	RSM mean±sd n=50	S.E.D (standard error of difference between two means)	Z value	P value
FVC	3.28 ± 1.04	2.56±0.86	0.56	1.28	>0.05 insignificant
FEV_1	2.72 ± 0.97	2.21±0.96	0.21	2.42	< 0.05 significant
FEV _{1%}	85.24±28.24	86.00±23.73	6.08	0.12	>0.05 insignificant
PEFR	7.80 ± 1.98	5.65 ± 2.18	0.46	4.67	< 0.05 significant
FEF _{25-75%}	4.28±0.99	3.34±1.37	0.24	3.91	< 0.05 significant

DISCUSSION

The study included data on 100 rural male subjects in the age group of 30-70 years divided into two groups consisting of, 50 non-smokers and 50 smokers.

The statistical data showed significant decrease in pulmonary function ('p' value less than <0.05) in smokers in comparison to non-smokers.

The non-smokers of rural population showed a significantly higher pulmonary function values than the rural smoker population but the FVC and FEV₁ showed insignificant difference.

As shown in Table 3, the mean FEV $_1$ at 2.72±0.97 litres was significantly higher in non-smoker males of rural population than the mean FEV $_1$ at 2.21±0.96 litres in rural smoker male population. The mean PEFR at 7.80±1.98 litres in rural non-smoker males was significantly higher than mean PEFR at 5.65±2.18 litres in rural smokers. The FEF $_{25-75\%}$ also showed a significant higher mean value at 4.28±0.99 litres than the mean FEF $_{25-75\%}$ at 3.34±1.37 litres in rural smokers. The FVC and FEV $_{1\%}$ was higher in rural non-smoker males than the rural smokers, but the difference was insignificant.

Smoking is a well-known cause to decrease the pulmonary functions, as shown by various previous studies. In our study smoking was attributed for the

difference in pulmonary functions between non-smokers and smokers. As per the WHO reports and other studies, if current smoking patterns persist, tobacco will kill about 1 billion people this century, mostly in low- and middle-income countries and about half of these deaths will occur before 70 years of age. ²⁻⁵

In our study the rural smokers showed a significant decrease in FEV_1 , PEFR and $FEF_{25-75\%}$. The study by Mhase and Reddy showed similar results with reduced FVC, FEV1 and $FEF_{25-75\%}$ in smokers as compared to nonsmokers.⁷

Diane RG, Xiaobin Wang et.al, showed a similar result of reduction in FEF_{25-75%} in smokers of 4% in boys and 3.2% in girls, when smoking 15 cigarettes or more per day was compared with never smoking subjects.⁸

The study by Vaidya et.al, showed significantly reduced FEV_1 and $FEF_{25-75\%}$ in smokers as compared to non-smokers and ex-smokers.¹³ In their study the FVC showed no significant difference which is similar to our results where FVC difference is insignificant in rural non-smokers and rural smokers.

The study by Bhargava and Khaliq showed similar results of lower lung volumes and capacities in active smokers and passive smokers than non-smokers. In their study also, the FVC and FEV_{1%} showed insignificant difference.

Smoking is a well-known cause to decrease the pulmonary functions, as shown by various previous studies. In our study smoking was attributed for the difference in pulmonary functions between nonsmokers and smokers. The role of other attributes like socioeconomic status, malnutrition, pollution affecting pulmonary function needs further evaluation.

CONCLUSION

There was significant decrease in pulmonary function in the rural smoker population in comparison to the nonsmoker population, however role of other attributes requires further studies in the population of Katihar, Bihar, India.

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institutional ethics committee

REFERENCES

- 1. Jha P, Peto R. Global Effects of Smoking, of Quitting and of Taxing Tobacco. New England J Med. 2014;370(1):60-8.
- Peto R, Lopez AD, Boreham J, Thun M. Mortality from smoking in developed countries, 1950-2010. Oxford, United Kingdom; Clinical Trial Service Unit and Epidemiological Studies Unit, March 2012.
- 3. Peto R, Lopez AD. The future worldwide health effects of current smoking patterns. In: Koop E, Pearson CE, Schwarz MR, eds. Critical issues in global health. San Francisco: Jossey-Bass; 2001:154-61.
- 4. Jha P. Avoidable global cancer deaths and total deaths from smoking; Nat Rev Cancer. 2009;9:655-64.
- 5. WHO report on the global tobacco epidemic, enforcing bans on tobacco advertising, promotion

- and sponsorship; Geneva: World Health Organization; 2013.
- 6. Abdullah AS, Husten CG. Promotion of smoking cessation in developing countries: a framework for urgent public health interventions. Thorax. 2004;59(7):623-30.
- 7. Jindal SK, Aggarwal AN, Chaudhry K, Chhabra SK, D Souza GA, Gupta D, et al. A multicentric study on epidemiology of chronic obstructive pulmonary disease and its relationship with tobacco smoking and environmental tobacco smoke exposure. Indian J Chest Dis Allied Sci. 2006;48(1):23-9.
- 8. Mhase VT, Reddy PS. Effect of smoking on lung functions of workers exposed to dust. Indian J Comm Med. 2002;27(1):26.
- 9. Gold DR, Wang X, Wypij D, Speizer FE, Ware JH, Dockery DW. Effects of cigarette smoking on lung function in adolescent boys and girls. New England J Med. 1996;335(13):931-7.
- Eishaan K, Bhargava, Farah Khaliq. Effect of paternal smoking on the pulmonary functions of adolescent males. Indian J Physiol Pharmacol. 2008;52(4):413-9.
- 11. Gavriely N, Nissan M, Cugell DW, Rubin AHE. Respiratory health screening using pulmonary function test and lung sound analysis; European Resp J. 1994;7:35-42.
- 12. Samet JM. A historical and epidemiologic perspective on respiratory symptoms questionnaires; Am J Epidemiol. 1978;108:435-45.
- 13. Sundblad BM, Larsson K, Nathell L. lung function testing influences the attitude towards smoking; Nicotine and Tobacco Res. 2010;12(1):37-42.

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