ORIGINAL ARTICLE

A POPULATION BASED STUDY OF PULMONARY FUNCTION BETWEEN URBAN AND RURAL SMOKERS OF KOSI REGION OF BIHAR, INDIA

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ABSTRACT: Smoking is well-known to cause respiratory disorders and pulmonary functions decline. 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 rural and urban areas. Rural and urban variations in disease distribution are well known. Respiratory system evaluation and screening can easily be done by Pulmonary Function Tests. This study was carried out in the Kosi region of Katihar, Bihar, in 100 participants. For this study, computerized spirometer (RMS Helios 701) was used. In view of increasing behaviour of smoking among the rural and urban population of Kosi region of Bihar, this study was undertaken, for a better understanding of the correlation between smoking and its effects on pulmonary functions. It was observed that pulmonary function in mean ± standard deviation in urban smokers, FVC was 2.54 ± 0.86 litres, FEV_1 1.81 ± 0.88 litres, FEV_1 % was 74.83 ± 31.43 and PEFR was 5.98 ± 2.35 litres and $FEF_{25-75\%}$ was 2.95 ± 1.31 litres. The pulmonary function tests in rural smoker population in mean ± standard deviation, FVC was 2.56 ± 0.86 litres, FEV_1 2.21 ± 0.96 litres, $FEV_{1\,\%}$ was 86.00 ± 23.73 and PEFR was 5.65 ± 2.18 litres and $FEF_{25-75\%}$ was 3.34 ± 1.37 litres. The comparison of PFT in urban smokers and rural smoker population was significant with "p" value <0.05 only in FEV_1, other parameters showed insignificant results.
KEYWORDS: Smoking, Urban, Rural, Pulmonary function test, Bihar.

INTRODUCTION: Rural and urban variations in disease distribution are well known. Chronic bronchitis, accidents, lung cancer, cardiovascular diseases, mental illness and drug dependence are usually more frequent in urban than in rural areas. On the other hand, skin and zoonotic diseases and soil- transmitted helminthes may be more frequent in rural areas than in urban areas. Death rates, especially infant and maternal mortality rates are higher for rural than urban areas. These variations may be due to differences in population density, social class, deficiencies in medical care, and levels of sanitation, education and environmental factors.[1] Due to socioeconomic differences, the majority of rural population is migrating to the urban areas, seeking education, income & occupation. This trend greatly increased the urban population, including urban slums in recent years. Tobacco kills more than five million people worldwide. Tobacco uses both in the smoking and non-smoking form is quite common in India; about 15% to over 50% men use tobacco in this country. Thus tobacco smoke related respiratory diseases like COPD, lung cancer etc., are increasing rapidly. Furthermore, tobacco consumption has a deleterious effect on the course of bronchial asthma, pulmonary tuberculosis, lung function and other lung diseases.[2]

Smoking produces inflammatory changes in small airways, especially in respiratory bronchioles. This leads to dilatation and destruction of small airways, characterized as emphysema.[3] The pulmonary damage induced by smoking acts slowly and may show no symptoms until pulmonary functions are lost.[4] In a study among urban and rural adult population Gaur et al., the prevalence of bronchial asthma and allergic rhinitis was found to be higher than reported earlier from India. Smoking was one of the major risk factors for higher prevalence of bronchial asthma and allergic rhinitis.[5] Pulmonary function test is a valuable tool for evaluation and assessment of the respiratory system. 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 rural and urban areas. Spirometry test alone 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.[6] Another commonly used method to assess pulmonary function is questionnaires, but the reliability of this method is limited.[7] Spirometry provides reproducible and quantifiable measures of pulmonary function.

MATERIALS AND METHODS: This study was carried out in the Kosi region of Katihar, Bihar, India. The sample size taken was 100. Prior consent was obtained from the Ethical committee. Informed consent was taken from the 100 participants before performing the pulmonary function tests.

For this study, the computerized spirometer (RMS Helios 701) was used. The spirometry test was done in the day time between 10.00 A.M. to 2.00 P.M to avoid any diurnal variations.

Daily calibration of spirometer was done with a 3 litre syringe, before starting the tests. The weighing machine was also calibrated daily with a standard 10 kg weight.

Written and informed consent was taken from the subjects before doing the pulmonary function test. A detailed history taking of the subject were asked. A complete general examination was done to rule out exclusion criteria.

SELECTION CRITERIA: Strict selection criteria were followed to select the sample size as mentioned below:

INCLUSION CRITERIA:

1. Informed consent from the subject.
2. Subjects in the age range between 20-70 years.
3. Smokers from rural and urban population of Kosi Region Katihar.
4. Smokers with present or past history of at least 5 years of smoking.

EXCLUSION CRITERIA:

1. Those subject who did not give consent.

2. Recent myocardial infarction less than one month old.
3. Asthma and COPD subjects.
4. Chronic infections such as tuberculosis or other infections of lungs.
5. Subjects with respiratory symptoms such as cough.
6. Hemoptysis of unknown origin (forced expiratory maneuver may aggravate the underlying condition).
7. Pneumothorax.
8. Thoracic, abdominal, or cerebral aneurysms.
9. Recent eye surgery (e.g., cataract).
10. Presence of an acute disease process that might interfere with test performance (e.g., nausea, vomiting).
11. Previous accidents or surgery involving thorax or abdomen.
12. Subjects who were not able to give desired co-operation for the test procedure.

In the start of study screening questionnaires were asked to confirm the exclusion criteria but later, it was omitted as history taking and general examination sufficed the purpose of selection criteria. 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.

These subjects were advised to come on next day for test. The statistical analysis was done using the˙ z˙ test, assuming´ p˙<0.05 as significant

OBSERVATION: Observations are presented in tables and histograms.

I. Pulmonary Function Test (PFT) results in Kosi Region of Bihar.

A. PFT results in urban smokers subjects.

PFT results in Urban Smokers (US) (n=50)		
Parameters	**Mean**	**Standard Deviation (SD)**
FVC (in litres)	2.54	0.86
FEV_1(in litres 1sec)	1.81	0.88
FEV_1% (percentage)	74.83	31.43
PEFR(in litres/min)	5.98	2.35
FEF_{25-75}% (in litres)	2.95	1.31

Table 1

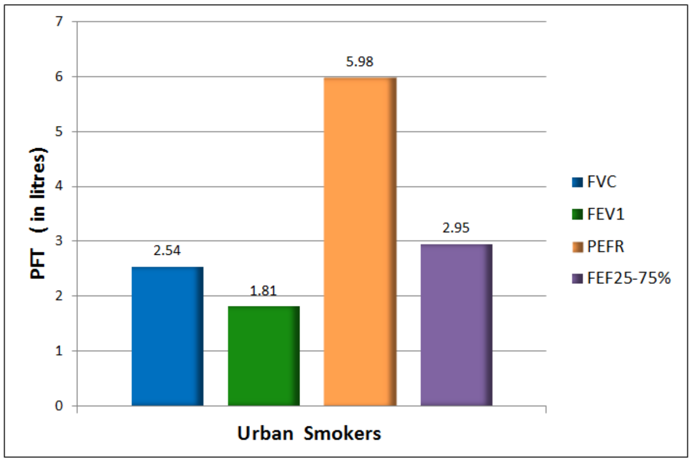

Chart 1

B. PFT results in rural smokers male.

PFT results in Rural Smokers (RS) (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 2

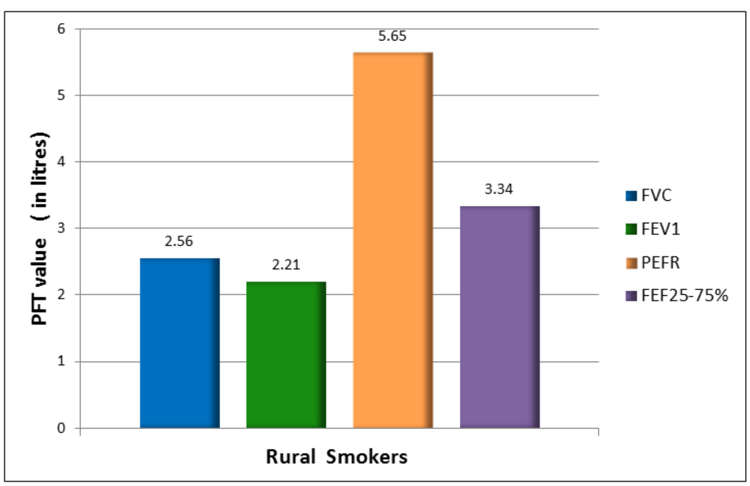

Chart 2

PFT	US MEAN±SD n=50	RS MEAN±SD n=50	S.E.D (Standard error of difference between two means)	Z value	P value
FVC	2.54±0.86	2.56±0.86	0.15	0.13	>0.05
FEV_1	1.81±0.88	2.21±0.96	0.16	2.5	<0.05 *
FEV_1%	74.83±31.43	86.00±23.73	5.56	2.00	>0.05
PEFR	5.98±2.35	5.65±2.18	0.44	0.75	>0.05
FEF_{25-75}%	2.95±1.31	3.34±1.37	0.24	1.62	>0.05

Table 3

* significant

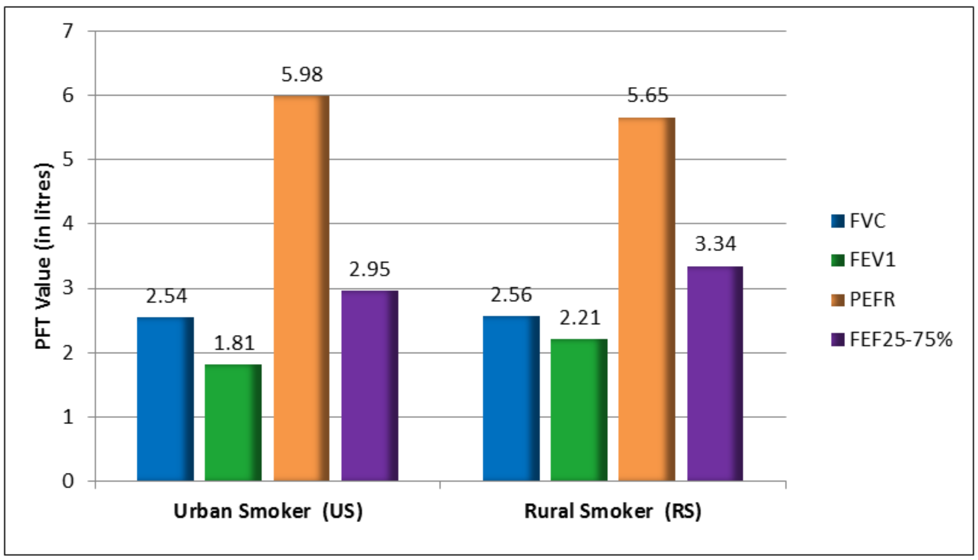

Chart 3

Table 1 and chart 1 shows pulmonary function tests in urban smoker population with different parameters, in mean ± standard deviation. FVC was 2.54± 0.86 litres, FEV1 1.81± 0.88 litres, FEV1 % was 74.83± 31.43 and PEFR was 5.98 ± 2.35 litres and FEF 25-75% was 2.95 ± 1.31 litres.

Table 2 and chart 2 shows pulmonary function tests in rural smoker population with different parameters, in mean ± standard deviation. FVC was 2.56 ± 0.86 litres, FEV_1 2.21± 0.96 litres, FEV_1 % was 86.00 ± 23.73 and PEFR was 5.65 ± 2.18 litres and FEF $_{25-75\%}$ was 3.34 ± 1.37 litres.

Table 3 and chart 3 shows the comparison of PFT in urban smokers and rural smoker population of Kosi region, Katihar, Bihar.

As shown in Table 3, chart 3 the mean FEV_1 in rural smoker population at a value of 2.21±0.96 litres was significantly higher in comparison to urban smoker males having a mean

FEV_1 of 1.81±0.88 litres. The mean FEV_1% also was higher in rural smoker population at a value of 86.00±23.73% in comparison to urban smoker population at a value of 74.83±31.43%. Data of comparative study was significant with "p" value <0.05. The other pulmonary function parameters were insignificant between smokers of urban and rural population ("p" value was >0.05).

DISCUSSION: This study included data on 100 subjects in the age group of 20 -70 years with 50 nonsmokers and 50 smokers. The study observed decreased pulmonary functions value in urban smoker population compared to the rural smoker population. It is showed in Table 3.that there were statistically significant changes in pulmonary function in terms of FEV_1 ("p" value < 0.05) between urban smokers and rural smoker population. The other pulmonary function parameters were insignificant between smokers of urban and rural population ("p" value was >0.05). Our study did not show any significant association between urban and rural population as shown by other workers. This may be explained by less sample size and lesser socioeconomic differences between urban and rural population of Katihar. Katihar is a small district of Bihar, where urban rural differences are not very wide. The air pollution and environmental factors are also not very much different between urban and rural population in Katihar as indicated by lesser number of vehicles, less construction works and industries in urban areas. The study done by previous workers were done mainly in major cities having wider variations between urban and rural areas. 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. 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.[1] The study by Gaur, Gupta, et.al, was done in Delhi having wider difference between urban and rural population. Their study showed a higher FEV1 in rural population while FEV1% was higher in urban population.[5] The study by Mohan Rao, et.al, was done in Andhra Pradesh, showed increased vital capacity, reduced FEV1% and FEF25-75% in rural workers in comparison to urban workers.[9] The Lisa Iversen et.al, study done in Scotland, showed that living in rural areas was associated with lower prevalence of asthma and has better health status in compared to urban population.[10] Their study was carried out by collection of postal questionnaires but our study is done by actual performance of pulmonary function tests by computerized spirometer. In our study the rural population has better pulmonary function in comparison to urban population in smoker category. The study by Glew et.al in children of northern Nigeria also showed higher pulmonary function in rural population as indicated by higher FVC and PEFR values in rural males in comparison to urban population.[11] In the study by Kostas NP, Michael BA et al. in school childrens of Athens showed adverse effects on lung function in urban population as compared to those living in rural environment.[12] Their methodology consisted of both, questionnaires and spirometric evaluation of lung function. Physical activities also affect pulmonary functions and the higher FEV1 in the rural smokers in our study may also be attributed to physical activity. As most of the rural male smokers were agricultural or other type of workers and were physically more active then the urban smoker population. This is in accordance with the CCHS study by Judith Garcia et.al. The Copenhagen City Heart Study (CCHS) by Judith Garcia et.al showed that moderate to high levels of regular physical activity were associated with a lower lung function decline in active smokers.[13] Our study was similar to the various studies done previously in Indian as well as Foreign studies and revealed urban population has decreased pulmonary function in FEV_1 parameter and a detailed pulmonary function assessment is required in Kosi Region of Bihar where prevalence of smoking is higher. The role of conditions like low socioeconomic status, malnutrition, pollution and other factors in affecting pulmonary function need to be evaluated.

CONCLUSION: There was significant decreased pulmonary function in the urban smoker population in comparison to the rural smoker population. Further study for the role of other factors affecting pulmonary function is required.

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