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“Comparative study of PEFR between the residents surrounding Puffed rice industries with the residents of Urban Davangere”

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ABSTRACT

Introduction: Industrial pollution has been a major factor causing the degradation of the environment around us, affecting the water we use, the air we breathe, and the soil we live on. In many developing countries air quality has deteriorated because of rising industrial activity. Puffed rice is a popular food item, which is produced in cluster of small units. Air pollution is the most serious problem in the Puffed Rice units in the form of particulate matter, carbon monoxide and other harmful airborne pollutants from tyre burning.5 So far very little data is available on extent and severity of the pollution that is caused by this cluster. Hence the present study is taken in Davangere. **Objectives:** To compare the lung function in terms of PEFR between the residents surrounding puffed rice industries with the residents of urban davangere and also to compare the effects with relation to duration of stay in that area **Material & Methods:** 65 healthy adult subjects of urban residential areas of Davangere and 61 healthy subjects of residents surrounding puffed rice industries within a radius of 500mts were selected randomly from the population of Davangere. The duration of the stay in the area is also considered to see the dose response relationship. **Results:** There was a drastic decrease in PEFR in residents surrounding puffed rice industries compared to the residents of urban davangere. It was also absorbed that the decrease was more in people who were residing in that area for a longer duration showing a dose response relationship. **Discussion:** This results because, smoking causes inflammation and narrowing of airways which results in increase in resistance to airflow and a decrease in elastic recoil pressure of the lungs. **Conclusion:** The actual values of PEFR are decreased in residents surrounding puffed rice industries compared to residents of urban Davangere and all the values are more decreased with increase in duration of stay in that area. The decrease in PEFR is more in the first ten year stay in this area indicating early peripheral airway narrowing and these effects worsen progressively with continued exposure.

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1.Introduction:

Industrial pollution has been a major factor causing the degradation of the environment around us, affecting the water we use, the air we breathe, and the soil we live on. In the last few years, several studies have reported significant associations between industrial pollution and various markers for acute respiratory morbidity¹. About 1.3 billion urban residents worldwide are exposed to air pollution level

above recommended limits². In many developing countries air quality has deteriorated because of rising industrial activity³.

Numerous epidemiological studies have documented decrements in pulmonary function and various other health problems associated with long-term air pollution exposure⁴. Puffed rice is a popular food item, which is produced in cluster of small units. Karnataka has some of the largest number of units. Around 800 small units are present in Davangere.

The environmental pollution from puffed rice units is a result of usage of low-grade hazardous fuels in primitive furnaces. Fuels used in the ovens are mainly rice husk, wood shavings, used

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automobile tyre, groundnut shell, and agricultural residues. The used automobile tyre is used in view of high heat it generates and low cost. Burning these fuels in highly inefficient conventional ovens generates high levels of particulate matter, carbon monoxide and other pollutants. Each furnace is loosely fitted with chimney, which is just 3-4 mts high. Thus the dispersion of pollutants is not high and as a result visible black clouds hover on the cluster and also neighboring areas. Thus, air pollution is the most serious problem in the Puffed Rice units in the form of particulate matter, carbon monoxide and other harmful airborne pollutants from tyre burning.⁵

Peak Expiratory Flow Rate (PEFR) is a sensitive indicator for predicting the magnitude of airway obstruction⁶. The immediate health effects of air pollution are borne by respiratory system resulting in acute bronchitis. The delayed effects are chronic bronchitis, lung cancer, bronchial asthma, emphysema and respiratory allergies. So far very little data is available on extent and severity of the pollution that is caused by this cluster. Hence the present study is taken in Davangere.

2.Objectives:

To compare the lung function in terms of PEFR between the residents surrounding puffed rice industries with the residents of urban davangere and also to compare the effects with relation to duration of stay in that area.

3.Material & Methods :

65 (34 male + 31 female) healthy adult subjects of urban residential areas of Davangere (control) and 61(30 males + 31 females) healthy subjects of residents of Azad nagar surrounding puffed rice industries (cases) within a radius of 500mts were selected randomly from the population of Davangere. The duration of the stay in the area is also considered to see the dose response relationship.

The inclusion criteria for this study, in the control group is

- Healthy adult subjects in the age group between 20- 40 yrs with no past history or present history of smoking.
- Healthy adult subjects with a history of residing within in the radius of 500mts of the puffed rice industries.

The exclusion criteria for this study were

- Children
- Subjects of less than 20 years or above 40 years
- Subjects between 20-40 years of age who are smokers, suffering from any diseases which directly or indirectly affects the lung functions of the subject.

Informed consent will be taken from all the subjects after detailed procedure of the non-invasive technique was explained to them. A brief personal history, smoking history and a clinical examination of all the systems will be done to exclude medical problems and to prevent confounding of result.

The PEFR of all the subject will be done in the morning session (Between 11 am to 1 pm). The physical characters such as height in centimeters and weight in kilograms of all the subjects will be recorded.

All there personal information like Age, Sex and a brief history will be entered in the patient information chart giving a separate ID for each subject.

We used WRIGHTS Peak flow meter which is a portable device for measuring ventilator functions.

The test is performed over 3 maneuvers. The tests with the best maneuver is selected.

The results are compared between the residents surrounding puffed rice industry and the residents of urban Davangere and statistically analyzed.

4.Statistical Analysis

The results were given as Mean \pm Standard Deviation and range values.

Comparisons were performed using students t-test for 2 group comparisons and one way ANOVA (Analysis Of Variance) for multiple groups.

The pvalue of 0.05 or less was considered as statistical significance.

5.Results

The actual values of PEFR in residents of Davangere ranges from 340 to 600 l/min with mean of 469.5 l/min. the same parameter in the residents of surrounding puffed rice industries ranged between 300-540 l/min with the mean of 411.1 l/min. The percentage of the predicted PEFR values in the residents of Davangere exhibited variations in the range of 80.0 to 110.8% with a mean of 93.1% while the percentage of predicted PEFR values among the residents surrounding puffed rice industries ranges from 62.8 to 103.7% with the mean of 83.3%.It was seen that the both the actual PEFR values and the percentage of predicted PEFR among the residents surrounding the industry indicated a decrease in the mean values. There was a statistically highly significant decrease in both the parameters. (Table 1).

Table 1: Comparison of PEFR in residents surrounding puffed rice industries and residents of urban davangere

Groups	N	Actual value (*l/min)		% predicted	
		Range	Mean +SD	Range	Mean +SD SD#
	65	340-600	469.50+65.4	80.0-110.8%	93.1+8.4
	61	300-540	411.1+58.0	62.8-103.7%	83.3+10.2
Mean diff			58.4		9.7
Significance T	t=5.29			t=5.89	
P	<0.001	HS		p<0.001	HS

On basis of the duration of the stay, residents surrounding the industries were divided into 3 groups and the data compared separately with that of the residents of urban Davangere. Out of the 61 individuals, 19 had been staying in the industrial area for less than 10 years, 30 of them have lived for more than 10 years but less than 20 years, while 12 of them have been living in the area for more than 20 years. The mean actual PEFR of those who have been staying from the last ten years is 425.3 l/min. The mean actual PEFR for those who have been staying in the region for more than 10 years and less than 20 years is 408.3 l/min and for those living for more than 20 years is 403.3 l/min. The mean percentage of predicted PEFR for the above three groups classified on basis of duration of stay in the region is 93.1%, 85.6% and 81.2% respectively. There has been a statistically significant decrease both in actual PEFR and percentage of predicted PEFR among the individual groups classified on basis of duration of stay in the area surrounding the puffed rice industries with those of Davangere taken separately (Table 2)

Table 2: PEFR in relation to duration of Exposure among residents surrounding puffed rice industries.

	N	Actual PEFR Mean \pm SD	Pred (%) Mean \pm SD
Residents surrounding puffed rice industries	65	469.5 \pm 65.4	93.1 \pm 8.4
<10 year	19	425.3 \pm 53.3	85.6 \pm 8.2
10-20 year	30	408.3 \pm 58.1	82.6 \pm 11.6
>20 years	12	403.3 \pm 61.0	81.2 \pm 9.0

6. Discussion

Our study "Comparative study of PEFR between the residents surrounding Puffed rice industries with the residents of urban Davangere" has shown a statistically significant decrease in the level of PEFR (9.7% of percentage predicted). It has also shown that, the PEFR has decreased more with increase of duration of stay in that areas. These findings were similar to those reported by O A Ileperuma [7], A Sagar et al [8], Jafary Z A et al [9], and A. S. Agarwal et al [10].

This results because, smoking causes inflammation and narrowing of airways which results in increase in resistance to airflow and a decrease in elastic recoil pressure of the lungs. Woodsmoke-emitted respirable particulates (<3.5 μ m), composed of a relatively equal mixture of ultrafine/fine (0.02–2.5 μ m) and coarse (2.5–3.5 μ m) particles can penetrate into the deep lung, producing a variety of morphological and biochemical changes [11].

7. Conclusion

The following conclusion can be drawn from the results of the present study.

- The actual values of PEFR are decreased in residents surrounding puffed rice industries compared to residents of urban Davangere and all the values are more decreased with increase in duration of stay in that area.

- The decrease in PEFR is more in the first ten year stay in this area indicating early peripheral airway narrowing and these effects worsen progressively with continued exposure.

Though our study is by no means exhaustive, it does provide a glimpse into the variety of adaptations/alterations in airway structure of the lungs and pulmonary functions, even in the absence of overt disease. Although we understand to some extent the pathophysiology of respiratory diseases to the effect of pollutants from puffed rice industries. Further research is recommended.

- Health education on hazards of pollutants of industries, preventive measures, legislation on banning of tyre burning and increase in the height of chimney in these places to be encouraged.

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