Research Article

Susceptibility towards obstructive lung change (FEV_1/FVC) in rice mill workers in comparison to normal adult individuals

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Abstract

Due to industrialization and global competitive market trend, rice mill has emerged as a major industrial activity in small medium scale sector to cater to the needs of increasing population. Occupational exposure to rice husk dust have been shownto affect functioning of different systems of the body. The present study was taken up to assess the Pulmonary Function Tests (FEV_1/FVC) in rice mill workers. **Methods**: Fifty non-smoker males in the age group of 18–30 years working in rice millsfor more than 1 year formed the study group. Age and sex matched individuals not exposed to rice husk dust served the control group. Pulmonary function parameters FEV_1, FVC and FEV_1/FVC were assessed using computerised Spirometer during their working hours and were statistically analysed. **Results:** There was a statistically significant decrease in FEV_1, FVC and FEV_1% in study group compared to control group with normal. **Conclusion:** The above findings point towards adverse effects of rice husk dust on lung function, mainly on lower airways with obstructive pattern of disease.

Keywords: Rice husk dust, Rice mill workers, Pulmonary function tests.

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INTRODUCTION

Indoor air pollution is a major problem in developing countries and is increasing more and more due to rapid industrialization and ineffective pollution control measures[1]. Exposure to industrial dust causes occupational airway obstruction due to chronic irritation of airways[2].Rice mill workers are continuously exposed to rice bran and husk dust and hence developing occupational lung diseases. Organic dust will contribute to abnormalities of lung thus leading to variety of health problems[3]. Keeping in view the hazardous of rice husk dust the present study was designed to investigate the susceptibility towards the lung changes (FEV_1/FVC) in rice mill workers in comparison to normal young adult individuals.

MATERIAL AND METHODS

The present study was conducted in various Rice mills with due permission of the owners. Ethical clearance was taken from the Institutional Ethical Committee and Consent was taken from each subject. Total sample sizes of 100 adults were chosen comprising of the Study group and Control group.The study group consisted of 50 males of age group of 20–50 years, who were working in various rice mills for more than 1 year. The control group consisted of 50 males of same age group, who were not exposed to rice husk dust, from the preclinical and paraclinical departments of JSS Medical College, Mysuru. The subjects chosen in the study and the control group had no history of allergic disorders, respiratory disorders like asthma, or any systemic disease and no history of smoking, chewing tobacco, intake of alcohol and no history of previous exposure to rice mill dust. Age, height, and weight were recorded. Pulmonary functions were tested during work shift using Medspiror®

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(a self-calibrating computerised spirometer that fulfils the criteria for standardised lung function tests). The parameters studied were, Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1), FEV_1/FVC (FEV_1%). The subjects were familiarised with the setup and detailed instructions were given. All the tests were carried out at the same time of the day, between 8.30AM to 9.30 AM to avoid possible diurnal variations. Tests were performed using the acceptability standard soutlined by the American Thoracic Society (ATS) with subjects in a standing position and wearing nose clips. The subjects were asked to breathe forcefully following deep inspiration into the mouthpiece. Expiration was maintained for aminimum period of 3–4 seconds, 3 to 4 trails of maximal inspiratory and expiratory efforts were made and the highest reading was taken for statistical analysis[4]. Statistical methods employed in the present study were Mean and Standard Deviation, Independent sample *t*-test and one way analysis of variance using SPSS-16 and compared between the study and control group. The *p* value less than 0.05was considered statistically significant.

RESULTS

Table 1: Anthropometric parameters of study group compared with their matched controls

Basic Characteristics	Study group (n=50)	Control group (n=50)	Significance	
			t -value	p- value
Age (years)	32.96 ± 8.12	33.52 ± 6.63	0.37	0.70, NS
Height (mts)	158.7 ± 0.99	159.94 ± 0.07	0.70	0.48, NS
Weight (kgs)	60.14 ± 8.23	62.66 ± 9.66	1.403	0.16, NS
BMI (kg/ m^2)	24.10 ± 5.26	24.53 ± 3.67	0.48	0.63, NS

Table 1 shows no significant difference in age, height, weight and BMI between rice mill workers and control subjects indicating samples were homogeneous in nature.

Table 2: Comparison of forced vital capacity (fvc), forced expiratory volume in first second (fev_1) and fev_1/ fvc of study group and control group

Parameter	Mean±SD		*t*-Test	*p- value*
	Study Group (n=50)	Control Group (n=50)		
Fvc(l)	2.40 ± 0.75	3.32 ± 0.59	6.72	0.000*
Fev1	2.21± 0.65	3.14± 0.53	7.71	0.000*
Fev1/Fvc	91.39± 6.98	95.09 ± 3.53	3.34	0.001*

All data presented are in Mean ± SD

[p>0.05 – Not significant (NS), p<0.05 – Significant (S), p<0.01 – Highly significant (HS)*]

Table 2 shows statistically significant decline in Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV_1) and FEV_1/ FVC in rice mill workers than control subjects

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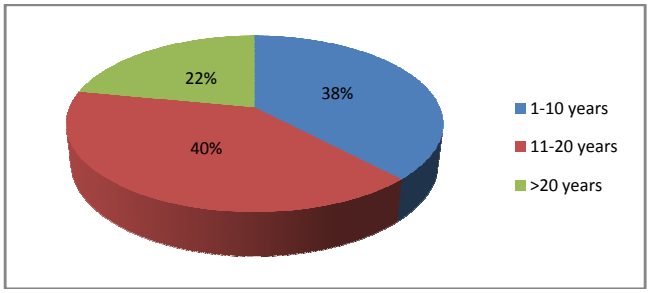

Figure 1: Division of study group according to duration of exposure to rice husk dust

Fig 1 shows division of study group according to duration of exposure to rice husk dust. Out of 50 cases 19 were exposed to1-10 years (38%), 20 were exposed to 11-20 years (40%) and 11(22%) were exposed to >20 years

Table 3: Comparison offorced vital capacity (fvc), forced expiratory volume in first second (fev_1) and fev_1/fvc with relation to duration of exposure to rice mill dust

Duration of exposure	n	FVC	FEV_1	FEV_1/FVC
1-10	19	3.21± 0.52	2.92 ± 0.35	92.76 ± 6.13
11-20	20	2.06± 0.29	1.96± 0.28	90.61 ± 6.74
>20	11	1.65± 0.14	1.45± 0.13	85.51± 8.54
ANOVA	P	0.00* HS	0.00* HS	0.028 S

HS: Highly significant, S: Significant.

Table 3 shows statistically highly significant reduction in FVC, $FEV_1$and significant reduction in FEV_1/ FVC with duration of exposure.

DISCUSSION

The prevalence of occupational lung disease varies from 15 – 30% in various parts of India[5].The lung with its extensive surface area high blood flow and thin alveolar epithelium is an important area of exposure with the substances in the envoirnment[6].They are usually induced by extended exposure to irritating or toxic substances that may cause acute or chronic respiratory ailments; however severe single exposure can also generate chronic lung diseases[7]. Rice mill dust is a complex organic dust with varied composition, including particles of husk, cuticular hair, pollen, bacteria and mucous spore. It is a respiratory sensitizer and chronic exposure to it affects the pulmonary functions and stimulates allergic response[8].when dust are inhaled macrophages dissolve the dust particles by surrounding them but the continuous exposure can lead to an overload situation so that the macrophages cannot deal and completely clear the particles. The particles are lodged in the airways and are responsible for setting up the inflammatory reaction, leading to restrictive and obstructive lung diseases[8]. Pulmonary Function Tests have opened a new era towards scientific approach in diagnosis, prognosis and management of pulmonary disorders by the early recognition of their alteration in industry workers who are constantly exposed to various dust pollutants and to institute protective and preventive measures to minimize the hazards of exposure to polluted enviornments[9]. Ideally the provision of appropriate monitoring programmes in industry should be an integral part of primary health care initiatives developed for working place with growing industrialization in India[17]. In the present study, lung functions in rice mill workers are significantly decreased as compared to their matched controls. Our study showed decreased FVC in rice mill workers. The decrease in FVC may be due to changes to the bronchii and elastic component of lungs resulting in restrictive type of lung impairment[10]. Decrease in FEV_1 shows that exposure to dust causes early obstructive pulmonary impairment[11]. This may be due to release of air borne endotoxins which may cause inflammatory reaction in the Broncho pulmonary system[12]. Decrease in FVC and FEV_1 may be due to obstructive impairment. This finding indicates the obstructive pattern of pulmonary involvement in the study group. This finding is consistent to that reported in a study carried out in Malaysia where FVC was significantly reduced but FEV_1 was almost found to be significant[13]. A study of the lung function tests in asymptomatic flour and rice mill workers showed reduced levels in flour mill workers when compared to rice mill workers. However the difference was not satisfactorily significant[14.] This study also reveals the decline of FVC, FEV_1 and FEV_1% with increase in duration of exposure. This may be due to the increase in irritation of upper respiratory tract mucosa due to prolonged exposure to rice husk dust resulting in hypertrophy of the mucosal lining. It results in increased secretion of mucus and formation of mucosal plugs leading to obstruction in exhaled air. These findings are in agreement with those of the study by Meo *et al*., in which a significant reduction of Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 second ($FEV_{1)}$, Peak Expiratory Flow rate (PEFR) and Maximum Voluntary Ventilation (MVV) was found among the workers who worked for more than 5-8 years[15]. The present study confirms that rice mill dust adversely affects the lung function parameters such as FVC, FEV_1 and FEV_1% and also there is direct relationship between the occupational period and the pulmonary abnormalities suggesting that ventilatory impairments are related with duration and nature of the exposure as well which causes an obstructive pattern of lung function impairment. The findings are of importance that they demonstrate the extensive need of preventive measures and show the magnitude of effects in survivor population. It is advisable therefore to adopt technical preventive measures such as having a well-ventilated work areas and wearing appropriate respiratory protective devices[16]. These measures will help to prevent lung damage, which is often, overtime contributes to morbidity and mortality.

CONCLUSION

Our findings point towards the adverse effects of rice mill dust on lung function showing obstructive pattern of disease compared to control group.

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