ISSN- O: 2458 - 868X, ISSN–P: 2458 – 8687
Index Copernicus Value: 49. 23
PubMed - National Library of Medicine - ID: 101731606

International Journal of Medical Science and Innovative Research (IJMSIR)
IJMSIR : A Medical Publication Hub
Available Online at: www.ijmsir.com
Volume – 4, Issue – 2, March - 2019, Page No. : 183 - 187

Evaluation of FVC, FEV_1, FEV_1/FVC (%) and FEF_{25-75}% in Male and Female Rice Mill Workers

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Fine dust inhalation over a long period of time leads to proliferative and fibrotic changes in the lungs. Rice being used as a staple food for South Indians, thousands of people employed in rice mills for their livelihood. This population is at risk of exposure to fine grain dust released during processing of rice grains. It has a long history of association with respiratory tract diseases and adverse effects on other organs of body such as eyes, nose and skin. Despite of presence of many pollutants released from industries in urban areas still the workers of rice mills are more prone to restrictive type of respiratory disorders. The present study is performed to evaluate the FVC, FEV1, FEV1/FVC (%) and FEF25-75% in males and female workers of rice mill and predict the obstructive and restrictive type of respiratory disorders. A cohort study, 100 rice mill workers non smokers were enrolled for the study from 5 different rice mills around Rangareddy District, Telangana. People with previous histories of respiratory disorder were eliminated from the study.Both males (78) and females (22) from age of 20 to 50 years were considered for study to avoid the bias. Pre shift and post shift spirometry was done for one week.

The statistical analysis was done by using Sigma Stat version (5.0), $p<0.05$, 95% Confidence Interval was considered statically significant with 80% power of the study. Procedure of spirometry was performed before and after the shift and data was collected to evaluate the statistical significance. Post-shift spirometric values in rice mill workers both male and females showed a decrease in FVC, FEV1, FEV1/FVC (%) and FEF 25-75% were statistically significant ($p<0.0001$, t-test) with pre-shift values. FVC, FEV1, FEV1/FVC (%) and FEF 25-75% recorded in males before shift was 2.8±0.26, 2.49±0.21, 87.92±7.87 and 2.89±0.47 and values after shift was 1.70±0.42, 1.19±0.31, 69.83±8.91 and 1.41± 0.28. FVC, FEV1, FEV1/FVC (%) and FEF 25-75% recorded in females before shift was 2.4±0.21, 1.8±0.14, 75±4.20 and 2.54±0.12 and after shift was 1.50±0.16, 1.4±0.3, 54±3.10 and FEF 25-75% and 2.14± 0.12 after shift. Evaluation FVC, FEV1, FEV1/FVC (%) and FEF 25-75% values of rice mill workers both male and female population showed a decrease in pulmonary function test (PFT) and they may more prone to restrictive disorders and obstructive type respiratory disorders in course of time.

Keywords: Obstructive, Respiratory Disorders, Restrictive, Rice mill, Spirometry.

Introduction

Industrial revolution has made modernization of urban places in growing countries worldwide which has increased the micro pollutant gases micro elements in air which has increased the pollutant levels in developing countries specially in India, 6 million people were effect from last one decade as per the reported by WHO [1]. Previous research in textile, cast and iron ore industries and paint industries, the exposure was so severe that mortality was increased in recent decade to almost all 5% every year [2]. Approximately 3.6 million workers in the European countries are exposed to fine dust in industry, fine dust has long been associated a variety of respiratory symptoms, including asthma, chronic bronchitis and rhinoconjunctivitis. The majority of studies were cross sectional in last 3 decades were respiratory diseases. Previous studies have shown an association between decreased lung function on fine dust exposure and noted that decrease in FEV_1 and FVC. Some studies have used cumulative exposure indexes to evaluate the differences in lung function. In a follow up study by SCHLU' NSEEN et.al; found significant association between inhalable fine dust and FEV_1 value. In Denmark, it has been estimated that, 70,000workers are occupationally exposed to fine dust. But little research was done on rice millworkers, micro pollutants released during processing; polishing of rice. The aim of present study was to investigate the decline in pulmonary function test (PFT) in male and females of rice mill workers.

Materials and Methods: A cohort study, 100 rice mill workers non smokers were enrolled for the study from 5 different rice mills around Rangareddy District, Telangana. People with previous history of respiratory disorder were eliminated from the study. Both males (78) and females (22) from age of 20 to 50 years are considered for study to avoid the bias. Pre shift and post shift spirometry was done for one week. Spirometry was performed for all subjects in sitting position with computerized spirometer (Spirolab III Italy). This device was auto calibrated and all tests were performed by the guidelines provided by the company. Pulmonary function test performed for each subject was before shift (8 AM) and after shift (6 PM) on the same day for continuously for week. Forced Vital capacity (FVC), Forced expiratory volume in 1 second (FEV_1), FEV_1/ FVC% and forced expiratory flow rates (FEF_{25-75}%) were recorded. Informed consent of Helnski type was obtained from each subject enrolled for study. Procedure was explained to each subject in their native language before the start of the procedure. Study was conducted, June 1997 to December 1998. The study was approved by institutional ethical committee, Osmania Medical College, Hyderabad.

Statistical analysis

The statistical analysis was done by using Sigma Stat version 5.0. $p< 0.05$, 95% Confidence Interval was considered as statically significant with 80% of power of study. t-test was used to draw the conclusion of the study.

Result

Procedure of spirometry was done before and after the end of shift and data was collected. Post- shift spirometric values in rice mill workers showed FVC and FEV_1, FEV1/FVC (%) and FEF_{25-75}% were significantly lower in rice mill workers ($p<0.0001$). FVC recorded in males before the shift was 2.8±0.26 and after the shift was 1.70±0.42, FEV1 before the shift was 2.49±0.21 and after the shift was 1.19±0.31, FEV1/FVC (%) 87.92±7.87 before shift and after shift was 69.83±8.91 and FEF_{25-75}% was 2.89±0.47 before shift 1.41± 0.28 after shift. FVC

recorded in females before the shift was 2.4±0.21 and after the shift was 1.50±0.16, FEV1 before the shift was 1.8±0.14 and after the shift was 1.19±0.31, FEV1/FVC (%) 75±4.20 before shift and after shift was 54±3.10 and FEF $_{25-75}$% was 2.54±0.12 before shift 2.14± 0.12after shift. (Table 1, Figure 1).

Table 1: Pulmonary function test in rice mill workers before and after working shift

	FVC (L)		FEV_1 (L)		FEV1/FVC (%)		FEF $_{25-75\%}$	
	Before	After	Before	After	Before	After	Before	After
Male (78)	2.8±0.26	1.70±0.42	2.49±0.21	1.19±0.31	87.92±7.87	69.83±8.91	2.89±0.47	1.41±0.28
t-value	19.66		30.66		13.43		23.89	
p-value	0.0001		0.0001		0.001		0.0001	
Female (22)	2.4±0.21	1.50±0.16	1.8±0.14	1.4±0.12	75±4.20	54±3.10	2.54±0.12	2.14±1.2
t-value	15.98		10.17		18.86		11.05	
p-value	0.0001		0.001		0.0001		0.001	

Data presented as Mean±SD, p<0.05, CI 95% with t-test.

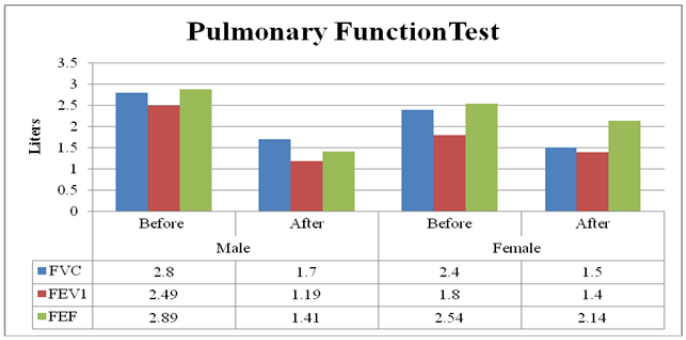

Figure 1- pulmonary function test before and after working shifts in rice mill workers, and statistically significant with other group p<0.05.

Discussion:

The study clearly shows that FVC, FEV_1, FEV1/FVC (%) and FEF $_{25-75}$% decreased post shift in both male and female rice millers, though we did not compared with the general population for their diurnal variations, previous literature showed decrease in lung functions when compared to general population [1]. A study in Davangere, Karnataka rice mill workers showed a significant decrease in FVC, FEV_1, FEV_1/FVC% and FEF $_{25-75}$% [2]. In an another study conducted by [3] Meo SA showed a significant reduction of FEV1, FVC, PEFR & MVV among the workers who worked more than 5-8 years similar to the present study findings [4]. Study by Ye et.al, among rice grain workers showed that there was an association between chronic grain-dust exposure and chronic airway obstruction [5]. While the present study showed that almost half of those who worked < 5 yrs showed obstructive respiratory disease and more than half of those who worked for 5-10 yrs showed restrictive respiratory disease. FVC goes on decreasing with increasing in duration of exposure to rice husk dust [6]. The decrease in FVC may be due to much more changes to the bronchi and elastic component of lungs resulting in restrictive type of lung impairment [7]. Decrease in FEV1 shows that exposure to dust causes early obstructive pulmonary impairment which further increases with increase in number of years of exposure [8]. This may be due to release of air borne endotoxin which may cause inflammatory reaction in the bronchopulmonary system [9]. The present study showed lower FVC among rice mill workers both male and females before and after shift and in compromise with other studies. Study done in flour mill workers in Egypt showed a significantly higher prevalence of cough, expectoration, breathlessness and reduced respiratory volumes among exposed group than non exposed ones. In the same study pulmonary functions deteriorated with increasing duration of exposure and heavily exposed fine dust during the work than lightly exposed [10]. Another study conducted among rice mill workers by Seema Pin Tumkur district of Karnataka showed higher prevalence of respiratory morbidity like cold, persistent cough with sputum with increasing duration of work [11]. Though more than half

workers complained of some respiratory morbidity in the past one year, there was no significant association found with the duration of work, age or gender in the present study. Study conducted by Razlan Musa in Malyasia among rice mill workers showed that chest tightness was the most common symptom followed by morning phlegm, shortness of breath, and morning cough [12]. Both age and duration of employment had significant relationship with shortness of breath whereas smoking had relationship with morning phlegm and morning cough, while the present study showed association of cough and phlegm, shortness of breath but not with any other variables. Decrease in lung function test parameters such as FVC, FEV_1, FEV1/FVC (%) and FEF_{25-75}% in rice mill workers may be due to exposure to fine dust released during the processing and polishing of rice, non use of face masks, poor ventilation and lack of proper exhaust facility in rice mill may be the culprit. Small sample size is the limitation of the study and more studies are warranted with more sample size and interventional methods use of nose mask or air filters.

Conclusion

FVC, FEV_1, FEV_1/FVC (%) and FEF_{25-75}% decrease with increasing age and lower among females. Pulmonary function test were found to be deteriorating with increase in inhalation of fine dust and duration of exposure in rice mill. An obstructive change occurs initially followed by restrictive changes when exposure was for long period of time. Therefore we recommend workers to have periodical clinical and spirometric evaluation. Workers showing significant impairment in lung functions should be readjusted to other sections where fine dust exposure is less. Workers were advised to use tight facemasks during working hours as routine and maximum necessary measures to be taken to control fine dust pollution in the rice mill.

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