

syndrome (4), Chronic bronchitis (5) or asthma (2). Environmental assessment of grain facilities showed the presence of biologically active endotoxins. This has been shown by Olenchok *et al.* (10). The Gram negative bacterial endotoxins can elicit profound immunotoxic and immuno-modulating effects *in vitro* and *in vivo* (9.1) and therefore can exacerbate adverse pulmonary reactions to grain dust. Pulmonary functions were studied in workers having occupational exposure to tobacco dust by Viegi (12). He reported a decline trend in forced end expiratory flow according to smoking habits and work duration. Elkarim (7) exhibited a significant drop in FEV₁ and FVC in the workers exposed to grain and flour dusts. Decrease in ventilatory capacity ranging from 200 ml to 800 ml were found in workers exposed to Barley dust (8). Long duration of exposure to tale dust showed decline in lung function in workers (3).

The present study has been undertaken to study the pulmonary function tests in Rice mill workers.

MATERIAL AND METHODS

The group under study consisted of all workers employed in 6 Rice mills of Lucknow. All together there were 150 male subjects. As controls, 50 workers employed as farmers in an agricultural work station in the same state were selected. The controls were of the same sex and ethnic group and from a similar agricultural work background but without exposure to Rice husk dust.

Modern med-spiror, manufactured by Med. Systems (P) Ltd., Chandigarh was used to determine the forced expiratory spiogram in both the groups.

The following parameters were studied :

- (1) Forced Vital Capacity (FVC)
- (2) Forced expiratory Volume in One second (FEV₁)
- (3) Forced expiratory volume in three seconds (FEV₂)
- (4) Peak expiratory flow rate (PEFR)
- (5) Maximum Voluntary ventilation (MVV)
- (6) Mean forced expiratory flow during the middle half of the FVC (FEF_{25-75%})

All these tests were performed in standing posture. Each subject was asked to exhale into the mouth piece of spirometer as forcibly as possible to measure FVC, FEV₁, FEV₃ and PEFR. The procedure was repeated 3 times and the highest reading was taken for calculation.

Next the subject was asked to ventilate into the mouth piece as forcibly and as quickly as possible for 10 seconds to measure M.V.V. During the measurements nostrils of the subjects were closed.

In each subject the age, height, weight and duration of exposure to Rice husk dust was recorded. Each subject was thoroughly screened for any active pulmonary lesion and those found suitable were actually selected for the study.

RESULTS

There was no significant difference between the mean age, height and weight of the subjects (31.5 years, 162 cm, 53.7 kgs) and the controls (32.4 years, 164.4 cm, 57 kg). The mean exposure period in Rice mill workers is 7.9 years with a standard deviation of 3.4. 57.33% of the workers were having the duration of exposure varying between 1 to 5 years 10.67% of the workers were belonging to exposure group of 6 to 10 years. 17.33% of the workers were having an exposure period varying between 11 to 15 years 14.67% of the workers were having the exposure period of 16 years or more.

Table I shows that the observed values of pulmonary function tests are significantly low in Rice mill workers as compared to that of unexposed control subjects. FVC, FEV₁, FEV₃, PEFR, FEF₂₅₋₇₅% and MVV are much low in Rice mill workers as compared to that of

TABLE I : Observed values of pulmonary function tests in Rice mill workers and unexposed control subjects.

Pulmonary function tests	Controls (n = 50)			Rice mill workers (n = 150)			't' value
	Mean	±	S. D.	Mean	±	S. D.	
1 - FEF 25-75% 1/sec	3.05		0.75	2.60		0.82	5.3
2 - FVC, ml	3480		372	3182		520	4.4
3 - FEV ₁ , ml	2900		352	2580		512	4.9
4 - FEV ₃ , ml	3480		372	3182		520	4.4
5 - PEFR 1/min	520		40.4	470		70.8	6.25
6 - MVV 1 min	105.7		14.00	91.0		18.8	2.3

t > 2 are significant

t < 2 are not significant

unexposed control subjects. Table II shows that the prevalence of obstructive type of pulmonary impairment is more frequent in the Rice mill workers who are having an exposure period of 16 years or more, 31.8% of Rice mill workers having an exposure period of 16 years or more, exhibited obstructive type of pulmonary impairment, whereas the incidence is only

TABLE II : Prevalence of obstructive pulmonary impairment in unexposed controls and Rice mill workers.

Exposure group (years)	Controls (n = 50)		Rice mill workers (n = 150)	
	No.	%	No.	%
0 - 5			11	12.79
6 - 10			4	25.00
11 - 15			6	23.07
16 or more			7	31.8
Total	2	4%	28	18.66%

12.79% in the Rice mill workers, having an exposure period between 1 to 5 years. Table III shows that the prevalence of restrictive type of pulmonary impairment is also more frequent

TABLE III : Prevalence of restrictive pulmonary impairment in unexposed controls and Rice mill workers.

Exposure group (years)	Controls (n = 50)		Rice mill workers (n = 50)	
	No.	%	No.	%
1 - 5			2	2.32
6 - 10			1	6.25
11 - 15			2	7.69
16 or more			3	13.6
Total	1	2%	8	5.33%

in the workers who are having much longer exposure period. Table IV shows highly significant negative correlation between duration of exposure of Rice husk dust with decline in

TABLE IV : Showing correlation coefficient (r) values between height, duration of exposure of Rice husk dust and pulmonary function tests in Rice mill workers.

Pulmonary function tests	Height	Duration of exposure
FVC	0.50	-0.72
FEV ₁	0.62	-0.76
FEV ₃	0.50	-0.72
PEFR	0.52	-0.68
MVV	0.20	-0.35

r > 0.4 are statistically significant (p < 0.05)

r > 0.5 are highly significant (p < 0.01)

FVC, FEV₁, FEV₃ and PEFR, whereas the decline in MVV was not much significant. Further, it shows that the height of mill workers is found to be positively correlated with FVC, FEV₁, FEV₃ and PEFR but no significant correlation was observed between height and MVV.

DISCUSSION

It is evident from Table IV that the duration of exposure to Rice husk dust in the workers is related to decline in FVC, FEV₁, FEV₃, and PEFR. This could be attributed to Rice husk dust causing damage to bronchial passages along with damage to the elastic component of alveolar walls. These results are in agreement with those of Damodar *et al.* (3), who reported decline in pulmonary functions due to exposure to talc dust.

The fall in FVC indicates restrictive lung changes and fall in FEV₁, PEFR and other flow rates indicate obstructive lung changes. The observations in this study indicate, that although obstructive pulmonary impairment is more frequent, both types of changes are present in the Rice mill workers. It is contended that Rice husk dust contains some airborne endotoxin which may cause inflammatory reaction in bronchopulmonary system. Airborne endotoxin is commonly present in a rice production commune (10).

It is well known that the height is positively related with vital capacity as the inner volume of thoracic cage is more in persons with greater height. In this study FVC, FEV₁, FEV₃, PEFR have been found to be directly related with height in rice mill workers.

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