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Effect of Jute Dust Exposure on Ventilatory Function and the Pertinence of Cough and Smoking to the Response

B. P. CHATTOPADHYAY, Sk. Jane ALAM, P. K. GANGOPADHYAY and H. N. SAIYED

Regional Occupational Health Centre (Eastern). Calcutta-700 016, India

Abstract : The ventilatory capacity of 32 men exposed to jute dust in the jute industry, was estimated at the beginning and end of shifts on the first day and last day of a working week. A detailed occupational, clinical and smoking history was recorded and a more detailed questionnaire on respiratory symptoms was completed prior to the pulmonary function tests. The presence of a productive cough among workers was noted. A mean decrease of forced expiratory volume at one second (FEV_1) was observed among workers according to processes, concentration of dust exposure and smoking habit on the first day and last day of the week. The mean difference of values was observed in most of the comparisons but only a few were statistically significant. Low mean values of FEV_1 were observed in workers having high dust exposure, a smoking history and productive cough in comparison to the low dust exposure group, non-smokers and workers without cough symptoms. The significant deterioration of FEV_1 was found between before shift and after shift values of the low dust exposed group of workers who had a cough and smoking history. The relevance of these factors on the ventilatory function is observed and discussed.

Key words: jute dust, occupational exposure, shift work, pulmonary function test.

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Introduction

In Eastern India, the jute industry plays a very important role among other industries. A major fraction of the population is involved in it. Like the cotton industry one other textile industry producing dust is the manufacturer of jute. Up till now very little has been known about the respiratory effects of jute dust, although a brief reference has been made to it by Arlidge and Schilling [1, 2].

Jute fibre is obtained from the bark of the two cultivated species of the Tiliaceae, that is, the genus *corchorus capsularis* and *corchorus olitorius*. It is usually grown in soils of alluvial origin. The most important use of jute is

for making fabrics for containers in which a large variety of commodities are transported or stored. It is also used in the making of carpets.

Jute dust is a non-toxic dust [3]. Most particles are large enough to be trapped in the nose and upper respiratory system. Only the small dust particles that reach the lungs contribute to the causes of certain non-specific lung diseases. Workers in the jute industry (as in other textile trades) are liable to contact "mill fever" especially at the beginning of employment. The condition lasts two to three days and frequently clears up without treatment. Byssinosis has not been identified in jute workers [3], even classical symptoms of byssinosis did not occur in those who were exposed to jute dust [4]. Siddhu *et al.* [3] and Mair *et al.*, [5] found no jute effects which caused byssinosis. Only Popa and co-workers [6] suggested that byssionsis could result from exposure to jute dust. Gandevia and Milne [7] stated that the ventilatory capacity of 46 workers exposed to jute dust showed a significant decrease in the FEV₁ on the first day of work. A subsequent study carried out by Valic and Zuskin [8], compared the effects of cotton and jute dust on respiratory symptoms in 60 cotton and 91 jute, non-smoking female workers of similar age and similar length of dust exposure. They showed that cotton workers had a significantly higher prevalence of byssinosis and of dyspnoea than did jute workers. But both the cotton and jute caused a significant reduction in ventilatory capacity on the first working shift of the week, with cotton dust having a significantly greater effect. Thus it showed that jute probably does lead to a shift decrement in the FEV₁ but its effect is much less than that of cotton and flax and may be non-specific. Morgan and Seaton [9] have reported similar chest symptoms like byssinosis subjects in jute and sisal workers but there is a controversy whether these textiles cause byssinosis or not.

The present study was undertaken with a view to establish the ventilatory capacity of 32 workers exposed to jute dust at the beginning and at the end of the shift on the first and last day of a working week. Smoking habit, duration of exposure in the jute mill and presence of a productive cough and productive phlegm was also considered in each case to interpret their values in these aspects.

Materials and Methods

Our observation was made on male jute mill workers. The volunteers for the present study were taken from two jute mills and were between the age, height, weight and body surface area range of 20–58 yr, 157–167 cm, 49–56 kg, 1.49–1.60 m² respectively. These subjects belonged to Batching, Spinning and Weaving departments. They were not suffering from any

respiratory diseases. The mean age duration of exposure of the batching, spinning and weaving workers were 43.08 ± 6.28 , 39.20 ± 12.00 , 42.20 ± 10.87 years and 21.16 ± 5.04 , 19.93 ± 4.54 , 20.40 ± 5.85 years respectively. The ventilatory function was done by a dry wedge bellows spirometer, and the vitalograph and peak expiratory flow rate by Wright's peak flow meter. The same instrument and technical hand recorded PFT throughout the study. All subjects were well motivated before the final recordings were taken. Pulmonary function measurements were made in a comfortable standing posture with a nose clip. The functional parameters used in this study were forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), forced expiratory flow rate at 27–75% of FVC and peak expiratory flow rate (PEFR). The recordings were taken twice a day after a weekly break on Monday and the following Saturday. The first recording was taken just before starting their work as a before shift value and the second recording was taken at the end of their shift on the same day as an after shift value. Similar recordings were also taken on the last day of the week that is on Saturday. The symbols A, B, C and D were allotted to the values for Monday morning, Monday afternoon, Saturday morning and Saturday afternoon respectively. The work processes and each man's job were reviewed as Batching (Selection, Softening, Carding and Preparing), Spinning and Weaving. Batching is considered to be the most dusty kind of work followed by spinning and weaving.

The concentration of the jute dust in the work environment of the above said two jute mills was measured [10]. The prescribed threshold limit value (TLV) for nuisance dust was 10 mg/m^3 stated by ACGIH, 1986-87 [11]. The highest concentration of the dust was found in the softening (batching) department (Mill I- 13.39 ± 3.92 , Mill II- 10.85 ± 5.60) which was above that level. The batching process as a whole was considered as a high dust zone (8.87 mg/m^3 and 6.86 mg/m^3) of the two jute mills. Workers studied from this process were considered as a high dust exposed group of workers and the workers of spinning and weaving were considered as in a low dust zone (1.50 mg/m^3 and 1.06 mg/m^3). These workers were considered as the low dust exposed group of workers. In the high dust zone the dust contained more mineral matters and coarse vegetable fibres of raw jute. The abrupt fall of the dust level in these mills to beyond the preparing stage has been termed as "low dust zone". It is accounted that the fibre fraction of jute dust is more and mineral matter is less in this region [10].

Among these workers 15 subjects were non-smokers and 17 were smokers. Smoker subjects had a smoking history of 15 to 20 bidi/cig. (or combined) per day. Details of the occupational and smoking histories of the subjects

were recorded by following a standard questionnaire. Lung volumes obtained were expressed in body temperature on the atmospheric pressure of air saturated with water vapour (BTPS). Body height and body weight were measured in barefeet on a standard scale. The body surface area was calculated by using the Du-Bois and Du-Bois formula [12].

Results

Pulmonary function test (PET) results on the first working day of the week after a weekend rest at the before shift and after shift period are presented in Table 1, similarly PFT results of the last day of the same week are depicted in Table 2. In both tables a comparison has been made between the before shift and after shift values of all PFT parameters. In each comparison, little mean difference of values was found which are statistically non-significant. Tables 3 to 9 set out the results of statistical analyses based on the change in FEV₁. In the text, reference to the relevant statistical data is made by means of the number in the left hand column of the appropriate table and term "Significant" implies 'P' in the right hand column. In Table 3, the

Table 1. Mean values for FVC, FEV₁, FEF_{25-75%} and PEFR of the first day of work

	First day before shift				First day after shift			
	FVC	FEV ₁	FEF _{25-75%}	PEFR	FVC	FEV ₁	FEF _{25-75%}	PEFR
	(<i>ℓ</i>)	(<i>ℓ</i>)	(<i>ℓ</i> /sec)	(<i>ℓ</i> /min)	(<i>ℓ</i>)	(<i>ℓ</i>)	(<i>ℓ</i> /sec)	(<i>ℓ</i> /min)
Batching n=12	2.77 ±0.87	1.93 ±0.83	1.37 ±0.73	381 ±96.62	2.77 ±0.62	1.94 ±0.66	1.43 ±0.81	380 ±95.47
Spinning n=5	3.05 ±0.81	2.37 ±0.56	1.88 ±0.42	475 ±49.11	2.93 ±0.91	2.27 ±0.62	1.89 ±0.57	468 ±50.57
Weaving n=15	3.41 ±0.45	2.64 ±0.48	2.44 ±0.98	481 ±91.54	3.16 ±0.54	2.52 ±0.56	2.39 ±0.94	478 ±101.92

Table 2. Mean values for FVC, FEV₁, FEF_{25-75%} and PEFR of the last day of work

	Last day before shift				Last day after shift			
	FVC	FEV ₁	FEF _{25-75%}	PEFR	FVC	FEV ₁	FEF _{25-75%}	PEFR
	(<i>ℓ</i>)	(<i>ℓ</i>)	(<i>ℓ</i> /sec)	(<i>ℓ</i> /min)	(<i>ℓ</i>)	(<i>ℓ</i>)	(<i>ℓ</i> /sec)	(<i>ℓ</i> /min)
Batching n=12	2.76 ±0.69	1.83 ±0.76	1.17 ±0.62	362 ±100.73	2.58 ±0.72	1.76 ±0.77	1.22 ±0.78	358 ±114.10
Spinning n=5	2.90 ±0.87	2.19 ±0.59	2.31 ±1.58	494 ±53.78	2.86 ±0.80	2.21 ±0.59	1.92 ±0.61	493 ±60.80
Weaving n=15	3.22 ±0.54	2.44 ±0.55	1.96 ±0.86	478 ±98.53	3.18 ±0.63	2.48 ±0.60	2.31 ±1.09	480 ±98.85

Table 3. Changes in FEV₁ for the entire series according to different departments

Name of Process	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
Batching n=12	1. A → B	-0.116	0.379	12	1.058	<0.40>0.30
	2. C → D	0.069	0.175	12	1.368	<0.20>0.10
	3. A → D	0.166	0.489	12	1.175	<0.30>0.20
	4. A → C	0.096	0.513	12	0.652	<0.60>0.50
Spinning n=5	1. A → B	0.096	0.149	5	1.435	<0.30>0.20
	2. C → D	0.012	0.052	5	0.515	<0.70>0.60
	3. A → D	0.158	0.112	5	3.147	<0.05>0.02
	4. A → C	0.176	0.073	5	5.399	<0.01>0.001
Weaving n=15	1. A → B	0.113	0.245	15	1.792	<0.10>0.05
	2. C → D	-0.037	0.221	15	0.653	<0.60>0.50
	3. A → D	0.165	0.185	15	2.962	<0.02>0.01
	4. A → C	0.185	0.212	15	3.388	<0.01>0.001

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

 $\bar{X}$ = Mean value, SD = Standard deviation, n = Number of workers,
t = '*t*' value, *P* = Level of significance.
Table 4. Changes in FEV₁ in relation to dust exposure

Sr. No.	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
1.	A → B Low dust exposure	0.109	0.221	20	2.199	<0.05>0.02
2.	A → B High dust exposure	-0.116	0.380	12	1.058	<0.40>0.30
3.	C → D Low dust exposure	-0.025	0.188	20	0.595	<0.60>0.50
4.	C → D High dust exposure	0.069	0.175	12	1.368	<0.20>0.10
5.	A → D Low dust exposure	0.163	0.193	20	3.793	<0.01>0.001
6.	A → D High dust exposure	0.166	0.489	12	1.175	<0.30>0.20
7.	A → C Low dust exposure	0.183	0.253	20	3.297	<0.01>0.001
8.	A → C High dust exposure	0.097	0.513	12	0.652	<0.60>0.50

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

 $\bar{X}$ = Mean value, SD = Standard deviation, n = Number of workers,
t = '*t*' value, *P* = Level of significance.

results of FEV₁ of workers according to different processes are presented. In the batching department no significant difference was noticed when the values of before shift and after shift were compared, but in the weaving and spinning departments significant changes were found when the values of Monday before shift and Saturday after shift and Monday before shift and Saturday before shift

were compared.

Table 4 represents the changes of FEV₁ due to dust exposure. In the present study 20 workers belonged to the low dust exposure group and 12

Table 5. Changes in FEV₁ in relation to dust exposure

Sr. No.	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
1.	A → B Low dust exposure with cough	0.021	0.054	7	1.038	<0.40>0.30
2.	A → B High dust exposure with cough	0	0.351	6	0	NS
3.	C → D Low dust exposure with cough	0.037	0.116	7	0.843	<0.50>0.40
4.	C → D High dust exposure with cough	0.043	0.230	6	0.461	<0.70>0.60
5.	A → D Low dust exposure with cough	0.145	0.095	7	4.06	<0.01>0.001
6.	A → D High dust exposure with cough	0.221	0.427	6	1.272	<0.30>0.20
7.	A → C Low dust exposure with cough	0.071	0.095	7	1.979	<0.10>0.05
8.	A → C High dust exposure with cough	0.178	0.407	6	1.072	<0.40>0.30

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

$\bar{X}$ =Mean value, SD=Standard deviation, n=Number of workers,
t=*t*' value, *P*=Level of significance.

Table 6. Changes in FEV₁ in relation to smoking

Sr. No.	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
1.	A → B Non-smokers	0.105	0.180	15	2.251	<0.05>0.02
2.	A → B Smokers	-0.027	0.364	17	0.313	<0.80>0.70
3.	C → D Non-smokers	0.043	0.099	15	1.691	<0.20>0.10
4.	C → D Smokers	-0.019	0.242	17	0.320	<0.80>0.70
5.	A → D Non-smokers	0.206	0.226	15	3.530	<0.01>0.001
6.	A → D Smokers	0.127	0.400	17	1.308	<0.30>0.20
7.	A → C Non-smokers	0.163	0.219	15	2.885	<0.02>0.01
8.	A → C Smokers	0.139	0.467	17	1.231	<0.30>0.20

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

$\bar{X}$ =Mean value, SD=Standard deviation, n=Number of workers,
t=*t*' value, *P*=Level of significance.

Fig. 1. Changes in FEV_1 over a working week for high dust and low dust exposed groups and for the entire series.

1. Workers of the entire series.
2. High dust exposed workers.
3. Low dust exposed workers.

- A = Monday before shift.
- ▨ B = Monday after shift.
- ▤ C = Saturday before shift.
- ▧ D = Saturday after shift.

workers to the high dust exposure group. In the high dust exposure group [10], the mean difference of values are too low and sometimes the after shift values are a little higher but still statistically non-significant. In the low dust exposure group, except for the changes of last day before shift and after shift, all the other three differences were statistically significant (108 ml, 164 ml and 183 ml respectively). Seven persons from the low dust exposure group and six persons from the high dust exposure group were observed to have a productive cough (Table 5). Among the differences, only the Monday before shift and Monday after shift (145 ml) were found statistically significant. An inconclusive finding was observed in the high dust exposure group. Further study in terms of possible relevant change of the mean FEV_1 over a working week for the the exposed workers is therefore necessary. The results are presented diagrammatically in Fig. 1. Influence of smoking on FEV_1 was presented in Table 6. In non-smokers the difference between Monday before shift and after shift are statistically significant, but in smokers these comparisons between the shift values were found to be statistically non-significant.

Table 7 shows that in the low dust exposure group, there are 9 non-smokers and 11 smokers. The workers having a smoking history were found to have significant differences in these comparisons 7.6 and 7.8, but in non-smokers the only statistically significant difference was noticed in the comparison 7.5, with the others being non-significant. Changes of the mean

Table 7. Changes in FEV₁ in relation to low dust exposure and smoking habit

Sr. No.	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
1.	A → B Low dust exposed non-smokers	0.043	0.172	9	0.754	<0.50>0.40
2.	A → B Low dust exposed smokers	0.163	0.249	11	2.162	<0.10>0.05
3.	C → D Low dust exposed non-smokers	0.014	0.087	9	0.498	<0.70>0.60
4.	C → D Low dust exposed smokers	-0.057	0.249	11	0.763	<0.50>0.40
5.	A → D Low dust exposed non-smokers	0.100	0.156	9	1.917	<0.10>0.05
6.	A → D Low dust exposed smokers	0.215	0.211	11	3.390	<0.01>0.001
7.	A → C Low dust exposed non-smokers	0.085	0.150	9	1.707	<0.20>0.10
8.	A → C Low dust exposed smokers	0.263	0.296	11	2.939	<0.02>0.01

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

$\bar{X}$ =Mean value, SD=Standard deviation, n=Number of workers,
t=*t*' value, *P*=Level of significance.

Fig. 2. Changes in mean FEV₁ over a working week for workers with or without a cough and with or without a smoking habit, and the workers of the entire series.

1. Workers having cough.
2. Workers without cough.
3. Workers without smoking habit.
4. Workers with smoking habit.
5. Workers of the entire series.

- A = Monday before shift.
- ▨ B = Monday after shift.
- ▤ C = Saturday before shift.
- ▥ D = Saturday after shift.

FEV₁ over a working week for non-smokers, smokers, workers having a cough and without a cough and the workers of the entire series are presented in Fig. 2. Results of the high dust exposure group with a smoking history is presented in Table 8. It was found that Monday before shift and after shift

Table 8. Changes in FEV₁ in relation to high dust exposure and smoking habit

Sr. No.	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
1.	A → B High dust exposed non-smokers	0.196	0.162	6	2.974	<0.05>0.02
2.	A → B High dust exposed smokers	-0.220	0.432	6	1.247	<0.30>0.20
3.	C → D High dust exposed non-smokers	0.086	0.108	6	1.962	<0.20>0.10
4.	C → D High dust exposed smokers	0.052	0.234	6	2.449	<0.10>0.05
5.	A → D High dust exposed non-smokers	0.367	0.231	6	3.879	<0.02>0.01
6.	A → D High dust exposed smokers	-0.035	0.612	6	0.139	<0.90>0.80
7.	A → C High dust exposed non-smokers	0.280	0.267	6	2.570	<0.05>0.02
8.	A → C High dust exposed smokers	-0.086	0.653	6	0.324	<0.80>0.70

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

$\bar{X}$ = Mean value, SD = Standard deviation, n = Number of workers,
t = '*t*' value, *P* = Level of significance.

Table 9. Changes in FEV₁ in relation to cough and smoking

Sr. No.	Decrease in FEV ₁	$\bar{X}$	SD	n	<i>t</i>	<i>P</i>
1.	A → B Cough symptoms as a whole	0.012	0.230	13	0.180	<0.90>0.80
2.	A → B Cough without smoking	0.140	0.197	4	1.418	<0.30>0.20
3.	A → B Cough with smoking	-0.046	0.230	9	0.594	<0.60>0.50
4.	C → D Cough symptoms as a whole	0.040	0.170	13	0.849	<0.50>0.40
5.	C → D Cough without smoking	0.072	0.123	4	1.178	<0.40>0.30
6.	C → D Cough with smoking	0.025	0.192	9	0.399	<0.70>0.60
7.	A → D Cough symptoms as a whole	0.181	0.286	13	2.275	<0.05>0.02
8.	A → D Cough without smoking	0.202	0.238	4	1.697	<0.20>0.10
9.	A → D Cough with smoking	0.171	0.318	9	1.614	<0.20>0.10
10.	A → C Cough symptoms as a whole	0.121	0.277	13	1.571	<0.20>0.10
11.	A → C Cough without smoking	0.101	0.320	9	0.948	<0.40>0.30
12.	A → C Cough with smoking	0.130	0.210	4	1.241	<0.40>0.30

A and B → First day (Monday) before shift and First day after shift.

C and D → Last day (Saturday) before shift and Last day after shift.

$\bar{X}$ = Mean value, SD = Standard deviation, n = Number of workers,
t = '*t*' value, *P* = Level of significance.

(8.1), Monday before shift and Saturday after shift (8.5) and Monday before shift and Saturday before shift values (8.7) of the high dust exposed non-smoker group had significant differences but in the smoker group no significant difference was observed. Interrelationship of cough with smoking history is tabulated in Table 9.

Discussion

The results of the present study indicated a mean decrease in FEV_1 in workers exposed predominantly to jute dust at the first day and last day of work after a weekend break. Detailed analysis revealed that this decrease was virtually confined to those who were observed to have a cough along with a smoking habit and exposed to dust. Among smokers, the before shift and after shift values are less than those of non-smokers. Mean values of all PET parameters measured are also lower in smokers in comparison to non-smokers. It was also found that the ventilatory capacity was reduced due to smoking and dust exposure.

Two other earlier studies on ventilatory capacity in jute workers during exposure have been reported. Mair *et al.* [5] found no significant changes in ventilatory capacity in eight jute workers during Monday and Thursday. Gilson *et al.* [13] also found no significant changes in 20 men during an unusually dusty Monday shift. Five of these men working in some of the dustier areas had symptoms of bronchitis, but they also showed no significant or consistent change in ventilatory capacity. Our findings are not in serious conflict with these results. It is, of course, possible that there are differences in the severity of dust exposure. Gandevia and Milne, [7] studied the cotton and jute industries and established that cotton dust is the more potent and consistent in its effect on the ventilatory capacity during a shift. Our results of jute workers may perhaps be viewed as a further illustration of a general principle which may be extended to include the possible interaction between environmental pollution and smoking in the development of ventilatory impairment. It also follows from this reasoning that it may be easier in an environment relatively free of pollution to isolate the effects of occupational exposure and to illustrate the relevance of such factors as smoking and productive cough to the ventilatory response.

Valic and Zuskin [8] reported that jute dust may cause a persistent cough and persistent phlegm. Their results suggest that jute dust is capable of causing a decrease in ventilatory capacity over a working day. The present investigation was in accordance with their results. Regarding the change of pulmonary function values according to exposure, it appears that as years of

exposure to jute dust increased the values reduced [14]. However, in the present study, the difference between the mean values for those who have minimal and those who have maximal exposure are statistically non-significant. Valic and Zuskin [8] also suggested that jute dust, although non-byssinogenic, is capable of causing a decrease in ventilatory capacity over a working day. Subjects having a persistent cough and persistent phlegm have significantly higher reductions in FEV_1 than those without such symptoms. Gandevia and Milne [7] reported the significant decrement of FEV_1 on the first working day. The same authors also reported that in six non-smokers employed for less than a month, there was a significant mean FEV_1 decrement of 140 ml over the first working shift after the weekend. In the present study the mean decrement of ventilatory capacity was found on the first day of work. Taking into account a very similar dust concentration, cotton dust appears to be more active in causing respiratory disease and acute lung function changes than jute dust [8]. Yet the effect of jute dust cannot be disregarded. Ghawabi [4] stated that there is no doubt that exposure to a high concentration of jute dust represents an occupational health hazard. It caused an acute reduction in ventilatory capacity during the shift that was considerably more pronounced in those who had chronic bronchitis. Jute dust exposure did not induce byssinosis but did lead to the development of chronic respiratory impairment [4]. The processing of vegetable fibres like St. Helena, Hemp, Manilla and Jute carries no specific hazards of byssinosis, although their dust may cause a chronic cough and sputum and a fall in FEV_1 during the work shift [15]. The particles are large enough to be trapped in the nose and upper respiratory system. Only the small dust particles reach the lungs and contribute to the causes of certain non-specific lung diseases. Although the etiologic agent of lung disease in vegetable dusts is unclear, mineral impurities, special chemical components of fibres and micro-organisms are commonly believed to be the main etiologic factors [16]. In softening of jute fibres, some oil and water is used and the jute is stored for 48 hours in a warm house at 25 °C. Bacteria and endotoxins may be produced by this time [16]. The endotoxin and the jute dust caused the obstructive type of lung function changes which were measured by FEV_1 . Ghawabi [4] reported a higher prevalence of chronic bronchitis and other obstructive types of respiratory symptoms in exposed workers compared to control. Rylander and Morey [17] stated that FEV_1 is the most commonly used parameter to measure the airflow obstruction caused by dust and endotoxins. The same author has reported that the airborne lipoproteins in jute dust is 0.02–0.05 $\mu\text{g}/\text{m}^3$ which is less than that of cotton dust, but may cause this type of changes. Zenlin and Zhou [18] stated that jute workers had significantly higher annual decrements of FVC,

FEV₁, FEF 25–75% than the control workers. Long term exposure to jute dust produces chronic loss of lung function.

Exposure to cotton dust and also to jute dust caused a significant reduction of FEV₁, FVC and PEFR on the first working shift of the week. The measurements of FEV₁ and PEFR in jute workers with and without respiratory symptoms have shown a greater mean reduction over the shift in FEV₁. Our results indicated a mean decrease in FEV₁ in workers exposed predominantly to jute dust during the the first day and last day of the working week. The significant deterioration of lung function in the low dust exposure group was found when compared between the before shift and after shift values that might be due to fibre fraction of dust which was found more in the low dust zone in comparison to the high dust zone [10]. The liberation of endotoxins from the fibres and the deposition of jute dust caused the obstruction of airflow, which reduced the FEV₁. Further detailed study is needed to better understand the etiology of jute dust induced lung diseases. It might be the inference of the view that some exposure to dust was necessary to produce the observed falls in FEV₁. It is now generally accepted that PET decrement will occur in an average working population due to occupational hazards, smoking habit and cough symptoms.

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インド麻粉塵の呼吸機能に及ぼす影響と湿咳および喫煙の関連性

B. P. チャトパジャイ, S. K. ジェンアラム,
P. K. ガンゴパジャイ, H. N. セイエド
東部地域産業保健センター, カルカッタ, インド

要 旨: インド麻工場での男性作業員 32 人について呼吸機能を調べた。職業歴, 病歴, 喫煙歴などの他, 呼吸器の症状に関する詳しい調査を行った後に肺機能のテストを行った。作業員の中には喀痰を伴う咳をする者もみられた。週の初日と比べると週の最終日には FEV_1 の平均値の低下がみられたので, 作業の種類, 作業場の粉塵の多少, あるいは喫煙習慣などとの関連性を調べた。 FEV_1 の低下が粉塵の多い作業場で働く人, 喫煙量の多い人, 湿咳のある人に多くみられたが, これらの因子との関連性に関しては統計学的には有意ではなかった。粉塵濃度の低い作業場で働く人で湿咳および喫煙歴をもつ作業員で仕事の後で FEV_1 の顕著な減少がみられた。これらの因子の肺機能に及ぼす影響を考察した。

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