





and the average of three readings was noted. Statistical analysis included tests of significance for means i.e. t-test, z-test and analysis of variance (ANOVA). Univariate analysis was carried out taking PEFR (outcome variable) as a continuous variable. To study the association between reduced PEFR and age, exposure to dust, sex, duration of exposure, smoking and respiratory morbidity Unconditional Multiple Logistic Regression Analysis was performed by using "MULTLR" statistical software package. This multivariate analysis was carried out by converting mean PEFR (discrete variable – dichotomized). The classification of PEFR into reduced or normal PEFR was based on the calculation of predicted PEFR by the formula –  $663.4 - 3.37 (\text{Age in years}) + 7.86 (\text{height in cms}) \pm 84$  given by Dikshit and Jog (10).

## RESULTS

The 319 subjects in each group included 245 males and 74 females. Table I shows age wise distribution of the mean observed PEFR among handloom weavers and

comparison group subjects. Two way ANOVA revealed that there is a significant difference in mean observed PEFR of handloom weavers and comparison group subjects while controlling for age ( $P < 0.001$ ). Similarly, mean observed PEFR differs significantly among different age groups while controlling for exposure ( $P < 0.001$ ). Also, significant interaction was observed between age and exposure with relation to observed PEFR ( $P < 0.001$ ). Independent 't' and 'z' test for different age groups revealed that there is a significant decline in mean observed PEFR after the age of 45 years.

Majority of the handloom weavers were in the profession of weaving since long time, the mean duration of exposure being  $32.69 \pm 17.34$  years. Table II shows mean observed PEFR (L/min) according to duration of exposure among handloom weavers. From Table II it can be observed that PEFR values decreased with the increasing exposure and the difference is statistically significant when the subjects having exposure for more than 30 years were compared with those having exposure for less than 30 years.

TABLE I : Mean observed REFR (L/min) according to age group among study subjects.

Age group (in years)	n	Handloom weavers		Comparison group		Tests results
		MOP*	SD*	MOP	SD	
<25	1	460	—	500	—	—
25–30	1	346.66	—	446.66	—	—
30–35	11	428.81	56.6	464.24	47.5	t=1.14, df=20, P>0.05
35–40	31	442.41	65.6	464.24	47.5	z=0.42, P>0.05
40–45	38	406.26	64.1	430.85	45.3	z=1.93, P>0.05
45–50	39	391.95	51.2	434.54	35.3	z=4.27, P<0.01
50–55	53	393.39	50.3	418.92	39.0	z=2.92, P<0.05
55–60	78	390.24	44.6	411.46	27.8	z=3.57, P<0.01
>60	67	357.89	48.3	403.53	33.2	z=6.37, P<0.01

\*MOP – Mean observed PEFR

#SD – Standard Deviation

TABLE II : Mean observed PEFR (L/min) according to duration of exposure among handloom weavers.

Duration of exposure (in years)	n	Mean observed PEFR	SD	Tests results
<10	4	365.83	53.2	t=1.56,df=42,P>0.05
10-19	40	410.74	68.3	z=0.156,P>0.05
20-29	59	408.40	79.9	z=2.25,P<0.05
>30	216	383.53	54.4	

TABLE III : Mean observed PEFR (L/min) in relation to smoking habit among study subjects.

Smoking habit	Handloom weavers				Comparison group			
	n	MOP	SD	Test results	n	MOP	SD	Test results
Smoker	41	387.63	19.89	t=3.18,df=62,P<0.05	54	390.74	21.57	z=4.3,P<0.01
Ex-smoker*	23	401.29	14.16		31	411.81	21.59	
Non smoker	181	400.76	9.56	t=0.17,df=202,P>0.05	160	414.39	16.45	z=0.63,P>0.05

\*Who left smoking for last one year or more.

TABLE IV : Mean observed PEFR (L/min) according to various morbid conditions among study subjects.

Morbid conditions	n	Mean observed PEFR (L/min)	2SE*	Mean+2SE
Chronic bronchitis	8	315.83#	64.1	251.73-379.93
Byssinosis	5	333.32#	42.9	290.42-376.22
Active pulmonary TB	3	302.22	115.4	186.82-417.62
Old healed pulmonary TB with symptoms	6	281.49#	106.7	174.79-388.19
Other chronic obstructive pulmonary disease	9	380.77#	38.7	342.07-419.47
Acute upper respiratory disorder	27	390.67#	24.7	330.54-373.34
Other	33	315.94#	21.4	330.54-373.34
Subjects with no morbid conditions	547	411.09	13.3	397.79-424.39

\*SE = Standard Error.

#When compared with those having no morbid condition the difference was statistically significant (P<0.05).

Table III shows mean observed PEFR (L/min) in relation to smoking habit among study subjects. In handloom weavers, smokers were having significantly lower

PEFR values than ex-smokers (t = 3.18, df = 62, P<0.05) and non-smokers (z = 4.12, P<0.001). Similarly, in comparison group subjects the PEFR of smokers was



TABLE V : Results of unconditional multiple logistic regression analysis.

<i>Risk factors</i>	<i>Odds ratio</i>	<i>95%CI</i>	<i>P value</i>
<b>Full Model</b>			
Age	0.57	0.51 – 1.37	0.0716
Sex	1.86	0.43 – 7.96	0.4027
Dust exposure	2.23	0.45 – 11.03	0.3220
Duration of exposure	0.76	0.15 – 3.83	0.7405
Smoking	1.60	0.57 – 4.51	0.3683
Respiratory morbidity	12.88	4.70 – 35.25	<0.0001
<b>Final Model</b>			
Age	1.12	1.02 – 1.56	0.0479
Respiratory morbidity	13.43	5.14 – 35.07	<0.0001

significantly lower than ex-smokers ( $z = 4.3$ ,  $P < 0.001$ ) and non-smokers ( $z = 7.36$ ,  $P < 0.001$ ).

Of the total 638 study subjects, 91 (61 among handloom weavers and 30 among comparison group subjects) has various morbid conditions, the respiratory morbidity being more common (63.7%), whereas 547 study subjects were normal with no morbidity. Table IV shows PEFR values of the study subjects having respiratory morbidities were significantly lower than the subjects having no respiratory or any other morbidity.

Table V describes the results of Unconditional Multiple Logistic Regression Analysis. The full model included age, sex, exposure to dust, duration of exposure, smoking and respiratory morbidity as risk factors for reduction in PEFR at  $\alpha = 0.1$ , the full model identified significant association of age and respiratory morbidity with reduced PEFR. The final model confirmed significance of this result at  $\alpha = 0.05$ .

## DISCUSSION

With the increasing age the PEFR decreases (6). This may be due to the decrease in chest muscle contraction with

the advancement of age. When the comparison group subjects of age 45 years and above were compared with handloom weaver of corresponding age, they had significantly higher PEFR values. This may be because of synergistic effect of cotton dust and advancing age in reducing the peak expiratory flow rate among handloom weavers.

The lower values of PEFR among handloom exposed to cotton dust for longer duration and among smokers in both groups suggest that cotton dust exposure and smoking has effect on PEFR. This is probably due to hypertrophy of mucosal cells due to irritation by cotton dust and smoke resulting in the increased secretion of mucus and formation of mucosal plugs which causes obstruction to the exhaled air (6).

This study also identified significant decline in PEFR among study subjects with respiratory morbidity except for active pulmonary tuberculosis. This non-significance of PEFR in pulmonary tuberculosis can be explained on the basis of very small sample size (three) and thereby estimates of PEFR resulting into wide confidence intervals. The relationship of decline of PEFR and respiratory



morbidity was also earlier reported by Florey and Leeder (11). These findings are further corroborated by a pathological study of byssinosis in which authors have detected abnormalities in large airways (12).

Although on univariate analysis, the current study identified significant association of reduction in PEFr with advancing age, duration of exposure to cotton dust, tobacco smoking and presence of respiratory morbidity, role of these factors except age and respiratory morbidity was identified to be non significant in multivariate environment. The univariate analysis was carried out by using PEFr (outcome variable) as a continuous variable, however, PEFr was dichotomized (reduced or normal) for performing Unconditional Multiple Logistic Regression Analysis. This

may have resulted a considerable extent of loss of information when the transformation of outcome variable (from continuous to discrete) was carried out. This may be important reason for non significance of duration of exposure to cotton dust and tobacco smoking in the multivariate analysis.

In conclusion, the present study recognized significant association of reduction in PEFr with advancing age, duration of exposure to cotton dust, tobacco smoking and presence of respiratory morbidity on univariate analysis. However, multivariate analysis recognized significant role of advancing age and presence of respiratory morbidity in the outcome of reduced PEFr.

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