

PEAK EXPIRATORY FLOW RATE OF CARPET WEAVING CHILDREN

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Objective: To assess the adverse influence of carpet weaving on lung functions and the nutritional status of children employed in such factories. **Design:** Comparison of the peak expiratory flow rate (PEFR) of the study group with controls of similar socioeconomic status and correlate it with anthropometric values. **Setting:** Field study. **Subjects:** One hundred and ten boys, 6-15 years of age engaged in 23 carpet weaving factories of Jaipur city. **Outcome Measures:** Linear regression analysis using age, height and weight as independent variables and PEFR as the dependent variable. **Results:** PEFR of carpet weaving children were significantly lower ($p < 0.05$) than controls for all except 6-7 years group. The height, weight and chest circumference of these children were also lower ($p < 0.05$). PEFR did not show significant difference when children were grouped according to their height. **Conclusions:** Children working in carpet weaving factories are shorter and lighter compared to normal school going children. As a consequence of the growth retardation, their PEFR values were also lower as compared to normal children.

Key words: Peak expiratory flow rate, Child labor, Carpet weaving.

CARPET weaving is a common industry of Jaipur. Many employees in this industry are children of school going age. Poverty and ignorance force these children to work in these weaving centres. Byssinosis was reported by Ozsemi *et al.*(1) in adult carpet weavers exposed to wool contaminated with endotoxin. We previously reported that carpet weaving children were nutritionally deficient, had frequent illnesses and showed significant growth retardation(2).

In order to evaluate the adverse effects of constant exposure to wool dust on the respiratory functions of these children, we measured their peak expiratory flow rate (PEFR) and compared with that of normal children.

Subjects and Methods

This cross-sectional study was conducted in 23 of 53 carpet weaving

factories situated within a perimeter of about two km from the walls surrounding Jaipur city. The factories were chosen on the basis of their easy approach and willingness of their owners to allow us to carry out our study. Thirty factory owners refused permission. Consent of parents of children enrolled for the study was obtained.

One hundred and ten boys (no girls were found employed), of 6-15 years of age, working continuously for most days of the past six months were included. Two hundred and ninety boys attending school in the same area and of similar age group and having similar socioeconomic status served as controls. Each child was subjected to a thorough clinical examination, and anthropometric measurements were taken by the standard techniques(3).

PEFR was recorded in both groups using the Wright's Mini Peak Flow Meter (Clement Clarke International Ltd., UK). Prior to recording the PEFr, the use of the instrument was repeatedly demonstrated. Each child was asked to take a deep breath and blow out forcibly into the flow meter at least five times at 15 minutes interval and the best reading was taken as the representative value. Children suffering from acute respiratory infections (ARI) at the time of measurement, and those with a history of ARI in the past two weeks were excluded from the study. Boys with a history suggestive of allergic rhinitis or bronchial asthma were also not included.

The results were statistically analyzed using linear regression analysis keeping age, weight and height as independent variables and PEFr as the dependent variable; regression equations were then formulated for PEFr versus height in the two groups.

Results

The maximum number of boys in the study group was in the age group of 11-13 yr, while in the control group they were in the age group of 9-11 yr. Mean duration of

employment in carpet weaving factories was 3.39 ± 1.51 yr with a range of 0.5 yr to 6.5 yr. The daily working hours varied from 10 to 14 hrs. Eleven boys in the weaving group (10%) admitted to have a habit of smoking bidis/cigarettes while none smoked in the control group.

A statistically significant difference ($p < 0.05$) in the PEFr of boys in the two groups was observed for all age groups except boys 6-7 yr old (*Table I*). The height, weight and chest circumference of boys in carpet weaving group were significantly lower than the controls in all age groups except between 6-8 yr(2). The difference in PEFr was found to be not significant when children in the two groups were matched according to their height (*Table II*).

The correlation coefficient (r) of physical parameters with PEFr were 0.7306, 0.8725 and 0.335 for age (yr), height (cm), and weight (kg) respectively for the school going group while the corresponding values for carpet weaving children were 0.6726, 0.8344 and 0.7212 respectively. These values were statistically significant with $p < 0.001$ for all the values observed.

Comparable regression equations, were

TABLE I—PEFR (L/minute) in Relation to Age

Age (yr)	Controls			Carpet weaving			P
	n	Mean	S.D.	n	Mean	S.D.	
6-7	36	179.4	32.66	5	168.0	11.66	NS
7-8	36	208.1	50.43	7	178.6	27.99	< 0.05
8-9	36	226.9	47.42	10	188.0	39.70	< 0.05
9-10	37	226.9	47.42	13	188.0	39.70	< 0.05
10-11	37	287.6	69.65	10	247.0	47.97	< 0.05
11-12	30	297.7	41.29	15	260.7	65.16	< 0.05
12-13	26	299.2	48.43	15	272.7	33.16	< 0.05
13-14	22	335.0	58.13	11	282.7	57.69	< 0.05
14-15	18	374.4	57.47	13	320.0	49.46	< 0.01

Children having ARI were excluded.

TABLE II—PEFR (L/minute) in Relation to Height

Height (cm)	Controls			Carpet weaving			P
	n	Mean	S.D.	n	Mean	S.D.	
100-110	8	153.8	15.76	4	150.0	18.71	NS
110-120	48	186.9	36.29	13	169.2	36.89	NS
120-130	87	229.3	42.00	27	215.6	35.52	NS
130-140	67	275.2	34.55	29	264.1	41.57	NS
140-150	44	322.9	38.99	21	309.1	33.37	NS
150-160	18	384.4	42.98	4	355.0	51.72	NS
160-170	8	431.2	40.75	1	420.0	—	NS

Children having ARI were excluded.

computed for PEFR versus height in the two groups: $4.93 \times \text{height (cm)} - 384.02 \pm 11.82$ L/minute for school going group, and $4.75 \times \text{height (cm)} - 370.38 \pm 13.19$ L/minute for carpet weaving group.

Discussion

Gupta *et al.*(4) showed that chronic bronchitis, pulmonary tuberculosis, bronchial asthma and byssinosis were frequent in cotton mill workers. The minimum duration between exposure to cotton dust and development of byssinosis was 7 years(4).

We observed significantly higher acute respiratory infections in carpet weaving children(2), but we did not see any case of byssinosis. This discrepancy is possibly because the mean duration of exposure in our study was only 3.4 yr. We utilized measurement of PEFR utilizing a peak flow meter to evaluate the pulmonary functions of carpet weaving children as it is claimed to be the most practical test for routine use in evaluating workers of cotton industry(5). We observed significantly lower values in carpet weaving boys compared to the control group. This difference was accounted for by the fact that boys in the former group were significantly shorter and lighter than the controls (2). In the age group of 6-7 years the difference in anthropometric

parameters was not significant and only a small difference in PEFR was observed.

Singh *et al.*(6) conducted a study of lung functions in workers of cotton spinning shops. They noticed a significantly lower PEFR in spinners as compared to control subjects. The other flow rates determined at lower lung volumes were also less in cotton spinners but not statistically significant. They postulated that even shorter duration of exposure to cotton dust in younger age group is not innocuous.

Symptoms of ARI were seen in 10% of carpet weaving children and 26.3% had a history of ARI in the past six months(2). Such a high prevalence of ARI in carpet weaving children should be viewed with a high degree of caution as it may be the initial manifestation of chronic bronchitis, asthma or byssinosis. Though we observed lower PEFR values in carpet weaving children as compared to the controls yet the difference was not statistically significant when anthropometric parameters were considered. An overall growth retardation observed in these children compared to controls accounted for the lower PEFR. This however, does not lessen in anyway the fact that this child labour force is exposed to an environmental hazard and need frequent medical checkups and

lung function testing to detect adverse effects.

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