Original article:

Respiratory symptoms and ventilatory functions among saw mill workers

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Abstract

Objective: To study the effect of saw dust exposure on respiratory symptoms and pulmonary function tests in saw millers.

Material and Methods: The study was carried out in sixty saw millers chronically exposed to saw dust and sixty five non exposed control group . A structured questionnaire was submitted for recording work history and information on respiratory symptoms, followed by spirometric evaluation of pulmonary functions.

Results: Cough and breathlessness was more prevalent in workers.FEV1%, FVC, FEV3%,MVV, PEFR showed a significant decline in workers.

Conclusion: Periodic pulmonary function assessment can be helpful in implementing interventional measures .

Keywords : Saw millers, ventilatory functions, Mixed pattern.

Introduction

About 200 species of trees are important in the wood industry,commonly used ones being teak,spruce, fir, mahogany etc. Wood dust is a by product formed during wood processing (1).A workplace having abundant wood dust exposure is the saw mill and airborne wood dust is a potential occupational hazard in the wood industry. It‘s inhalation has been associated with upper and lower respiratory tract symptoms (2), chronic bronchitis,alveolitis,asthma etc (3). Long term inhalation of wood dust in suboptimal working conditions results in increased morbidity,hence the present study was designed to find the prevalence of respiratory symptoms and measure lung functions of saw mill workers in Akola district.

Material and Methods

The study population comprised of sixty male saw mill workers in the age group of 30-50 years. Saw mills were usually sheds with roof tops,having heaps of sawdust on the floor. Major activities in a saw mill being cutting of timber logs and shaping. On an average 10-20 workers are employed in each mill. These workers worked for at least 8-9 hours per day, at various saw mills in Akola, six days per week and were in the said occupation for more than three years. Subjects with any known cardiovascular or respiratory disease were excluded; similarly smokers and subjects having exposure to any pollutant/contaminant other than saw dust were excluded from the study. An equal number of unexposed subjects in the similar age group who matched the saw mill workers by socioeconomic status, height, weight, body mass index were chosen

as controls. Subjects were administered a standard questionnaire which included questions on work history and respiratory symptoms. Work history included duration of exposure, working hours, job description and working conditions. General and systemic examination was then carried out and finally spirometry was carried out by computerized pulmonary function test machine. Instrument was properly calibrated. Subjects were adequately instructed, Three or more tracings were recorded and tracing with maximum effort was selected. Parameters measured were forced vital capacity-FVC, forced expiratory volume in one second-FEV1, forced expiratory ratio FEV1/FVC%, FEV3/FVC%, Peak expiratory flow rate-PEFR, Maximum voluntary ventilation-MVV. Data appears as actual value, predicted value, and percent predicted i.e. actual value/predicted value × 100 .All the measured values were at BTPS. Results were expressed as percentages of predicted values according to the standard guidelines (4,5). Statistical analysis for comparison between the two groups was done by unpaired t test, using Microsoft excel. Written informed consent was obtained from all participants prior to the study. The study design was approved by the local ethical committee.

Results

60 saw millers and 65 unexposed subjects were examined .The mean age of the workers was 36.5 ±8.5 years while that of the control group was 38.6 ± 10.3 years, the difference being statistically non significant .

None of the workers used any protective aid. Respiratory symptoms were significantly different between both the groups, breathlessness and cough being predominantly present in the saw mill workers. (Tableno.1). Saw mill workers had lower FVC, FEV1% compared to controls with statistically significant differences. PEFR and MVV values showed a decline in the saw mill group. (Table no. 2)

Table no. 1

Respiratory symptoms	Control (%)	Saw mill workers (%)	p value
Cough	7	72	< 0.001**
Breathlessness	10	59	< 0.001**
Chest pain	2	3	> 0.05

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Table no. 2

Parameters	Control Group	Saw Mill Workers	p Value
	Mean ±S.D.	Mean ± S.D.	< 0.001**
FVC (L)	3.57± 0.11	3.04 ± 0.20	< 0.001**
FEV1/FVC (%)	86.3 ±5.96	67.4 ± 10.8	< 0.001**
FEV3/FVC (%)	94.65 ± 12.2	91.57 ± 4.82	< 0.001**
PEFR(L/SEC)	6.36 ± 0.172	5.71 ± 0.15	< 0.05*
MVV(L)	109.36 ± 16.62	80.38 ± 13.21	< 0.05*

**-Highly significant, *--Significant

Discussion

Saw dust is a heterogenous organic substance possessing irritant and sensitizing properties. Dust comprises of saw particles and may contain contaminants, bacterial endotoxins, insects, mites, cellulose and resins etc (6), certain fungi or adhesives act as allergens. Prevalence of respiratory symptoms was significantly higher in the mill workers as compared to controls. This finding suggests that wood dust exposure increases the risk of pulmonary disorders. This is in agreement to similar studies on saw mill workers who found inspirable saw dust increasing the frequency of respiratory symptoms and correlated it to the long period of exposure (7).Longer duration of employment was associated with higher - prevalence of allergic symptoms (8).

Significance of spirometry as an important diagnostic tool in occupational respiratory diseases is well documented (4). In an occupational setting these tests are beneficial in the early recognition of lung dysfunction although workers may be clinically normal. Similar decrease in values of FVC, PEFR, FEV1 was noted in other studies (9,10) with chronic exposure to a high concentration of dust impairing pulmonary functions.

Our studies point towards a mixed pattern of impairment in saw millers with reduction in FVC accompanied by mild obstruction as FEV1% ranges between 60-70%. Physical processes which decrease elastic recoil or increase airflow resistance or increase airway wall compliance will decrease flow rates that can be normally achieved.

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Airway resistance increases in event of narrowing which could be the result of either contraction of bronchial smooth muscle or thickening of airway walls. Putative mechanisms for bronchoconstrction being hypersensitivity, inflammation and reflex bronchoconstriction. Inhaled antigen in dust combines with immunoglobulin E releasing a primary mediator like histamine resulting in bronchspasm. Immunologic responses to saw dust exposure have been reported (11). A bronchial reaction to challenge with certain woods is known (12).Secondly, bronchoconstriction can be ascribed to persistent bronchial inflammation making the airways hyperresponsive. Low grade infection in chronic dust exposure triggers an inflammatory response with subsequent fibrosis and decreased elasticity of lung tissue (13). Finally, reflex bronchoconstriction on stimulation of sensory receptors in the airways by irritants and certain chemicals mediated by cholinergic pathways causes bronchoconstriction. For the present study decreased expiratory flow rates can be attributed to obstruction of the airways. Our results tally with those of Zuhair, C Whitaker(10) who found a decline in FEV1 in saw mill workers with an obstructive trend of impairment in workers exposed for a duration exceeding five years. Abe Sosman et al (12) in 1905,showed that use of south African boxwood (Gonioma Kamassi) in shuttle making in Lancashire caused a great deal of disability. Carosso,C Ruffino(14) observed a large decline and it was attributed to inclusion of symptomatic subjects.Findings of PEFR are in accordance those of M Ramesh Bhat , C Ramaswamy and Shamssain M H (15,16) indicating decline in PEFR before their workshift. The reduced airway patency in the workers lowers the MVV. To summarize, since FVC, FEV1, PEFR and MVV are determined principally by events during forced expiration they decrease with decline in maximal flow rates.

Conclusion

Long term exposure to saw dust damages tracheobronchial tree as evidenced by respiratory discomfort and reduction in pulmonary functions. Saw mill workers must undergo a pre- employment and periodic medical surveillance test, to identify susceptible workers for preventing further significant deterioration and reduce sickness absenteeism. Preventive technical strategies including use of respirator, masks, local exhaust ventilation and a follow up schedule comprising of pulmonary function tests, X ray chest and sputum examination at least once a year are recommended.

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