

**Research Article****Effect of Chronic Exposure of Sawdust in Workers Employed in Sawmills: A Cross-Sectional Study****Anupriya Deshpande<sup>1\*</sup>, Afroz Afshan<sup>2</sup>**<sup>1</sup>Assistant Professor, Department of Physiology, IMSR, Mayani, Satara-416401, Maharashtra, India<sup>2</sup>Assistant Professor, Department of Physiology, KIMS, Amalapuram-533201, Andhra Pradesh, India**\*Corresponding author**

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**Abstract:** Increase in industrialization as well as sophisticated life style is leading to increased indoor air pollution causing major health problems in our developing country, India. Chronic exposure to saw dust affects the worker's lung functions and stimulates allergic responses. Present study is designed to investigate the effects of saw dust on the lung functions as it puts the workers' health into jeopardy. Spirometry is a readily available tool to detect lung function abnormalities at an early stage. The aim was to study and compare the effects of saw dust on pulmonary functions of nonsmoking male saw mill workers with those of healthy subjects unexposed to saw dust. 50 adult non-smoking male workers from saw mills were selected for our study. 50 age and sex matched healthy subjects unexposed to such an occupational hazard were taken as controls. Forced expiratory spirometry was recorded by RMS medspiror. Parameters such as forced vital capacity (FVC), forced expiratory volume in 1st second (FEV1), the ratio of FEV1/FVC, forced expiratory flow in the middle half of FVC (FEF25-75%), peak expiratory flow rate (PEFR) and maximum voluntary ventilation (MVV) were assessed in both cases and controls. The results were analyzed by using the student's unpaired t-test. Saw mill workers showed greater decline in FVC, FEV1, FEF25-75%, PEFR, MVV and FEV1/FVC ratio which is statistically highly significant, suggesting obstructive pulmonary disorder.**Keywords:** Sawdust; Pulmonary functions; Spirometer

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**INTRODUCTION**

Occupational dust exposure in the long run leads to various respiratory ailments. About 10% of adult asthma cases are due to occupational dust exposure [1]. Chronic exposure to wood dust is common with carpenters; sawmill workers and furniture making industry. The causative factor for occupational asthma is saw/wood dust.

Wood contains microorganisms (including fungi), toxins and chemical substances and they may significantly affect human health [2]. It is recognized that those agents may cause irritation of oral cavity and throat, tightness of the chest, irritant dermatitis, urticaria, alveolitis, deterioration of pulmonary functions and a reduction of FEV1[3].

Dust is said to be the tiny particles dispersed in air due to mechanical disintegration of materials by impulsive forces such as crushing, grinding, milling etc. [4]. The occupationally related pulmonary diseases are most likely due to dust deposition in the lungs that are influenced by the composition of dust, the duration of exposure to dust, the concentration and physical

properties of airborne dust in the breathing zone [5]. Studies on workers in furniture manufacturing sector evidenced that upper and lower respiratory system symptoms increased in people exposed to wood dust [6]. These symptoms are related to the exposure levels and seen frequently in cases of exposures higher than 5 mg/cum [7].

Dust particles which are inhaled and lodged in the lung irritate and set up an inflammatory reaction. Healing of this inflammation causes fibrosis leading to defective oxygen diffusion and impaired lung functions [8]. Sawmilling is one of the common wood processing industries which involve cutting, processing and shaping of wood [9].

**MATERIALS AND METHODS**

The present study was conducted in Salgar hospital, Gulbarga during the year 2012 to 2013 after obtaining ethical committee clearance from the institute. This study was undertaken to observe the effects of increased duration of exposure to saw dust on the pulmonary functions of adult workers of age group 20-60years. Fifty male sawmill workers who were

involved in sawmilling for more than four years were taken as study group. The study groups were matched for age, height, weight and Body Mass Index [BMI].

#### **Inclusion and exclusion criteria**

The study was undertaken in 50 healthy male subjects employed in sawmilling, age ranging from 20 to 60 years. These workers worked for at least 6-8 hours a day for 6 days a week. 50 apparently healthy male non-smokers control subjects were also selected. All subjects were matched for age, height and weight. Exclusion criteria for subjects of our study include those who had undergone abdominal or chest surgery, subjects with clinical abnormalities of spine and thorax, diabetes mellitus, hypertension, pulmonary tuberculosis, bronchial asthma, chronic bronchitis, emphysema and other lung diseases.

Informed written consent was taken from each subject after explaining the procedure in their local language. A questionnaire containing 20 questions was used in the study. The questionnaire included questions relating to the worker's demographic data, smoking status, medical history, occupational background, personal protective equipment usage status and complaints about work. The questionnaire was filled during face-to-face interviews.

A detailed history was taken and a clinical examination of all the systems was done to exclude medical problems. BMI was calculated from the Height (m) and weight (Kg) of the subjects. RMS Medspiror, a computerized spirometer was used to determine their lung functions. Software from Recorders and Medicare system is loaded onto the computer for calculation of the predicted values for age, sex, weight and height. It also gives the recorded values.

Procedure was explained and demonstrated to the subjects before they actually took it up. They were also encouraged to practice the maneuver before commencing it. The test was performed with the subject in upright position and was repeated three times with adequate rest. The test with the best maneuver was selected.

MVV was assessed by asking the subject to inhale and exhale as rapidly and deeply as possible for a period of 15 seconds.

The results for each parameter were compared between the study groups and were statistically analyzed.

#### **RESULTS AND DISCUSSION**

Occupational respiratory diseases are usually caused by extended exposure to irritating or toxic substances that cause acute or chronic respiratory ailments [10].

Many pulmonary diseases arising out of workplace environment and the subsequent exposure to harmful substances are being recognized in the 21<sup>st</sup> century [11].

Decline in FVC, FEV1, FEF 25-75%, PEFR and MVV among the sawmill workers could be due to the accumulation of dust particles in the air passages [12].

Chronic dust exposure impairs the phagocytic activity of alveolar macrophages and also affects the mucociliary performance. When the dust particles are inhaled, scavenger cells like macrophages dissolve the dust by surrounding it, but if there is dust overload, the macrophages fail to completely clear the dust; consequently the dust particles lodge in and irritate the lungs setting up an inflammation in the small airways of the lung. The healing of the inflammation by fibrosis leads to thickening of lining of airways leading to obstruction [8, 13, 16].

This study was undertaken to observe the effects of increased duration of exposure to saw dust on the pulmonary functions of adult male workers of age group 20-60 years. We found a decrease in all the lung parameters in the saw mill workers compared to controls ( $p < 0.001$ ). The decrease in PEFR observed in sawmill workers is in conformity with the reports of Fatusi and Erhabor [14] and Ugheoke *et al.* [15]. The reduction in PEFR in mill workers might be attributed to inflammatory changes in the respiratory tracts which leads to increased airway resistance as a result of the saw dust exposure thereby bringing about the remodeling of the airway and consequently lung dysfunction.

Another study revealed similar results as the mean values of FEV1 and FVC in the furniture workers were significantly lower than those in the control group [17]. Exposure to pine wood dust increases the risk of atopy and obstructive and restrictive pulmonary effects [18].

**Table 1: Age wise distribution of sawmill workers and controls**

Age in years	Sawmill workers (n)	Controls (n)
20-30	22	20
31-40	18	16
41-50	6	6
51-60	4	4
Total	50	50

**Table 2: Basic characteristics of subjects**

Basic characteristics	Sawmill workers (n = 50)	Controls (n = 50)	Significance	
			t-value	p-level
Age in years	38.8 ± 8.1	36.1 ± 7.8	1.68	0.10
Height (cm)	160.4 ± 6.4	161.8 ± 0.9	0.90	0.37
Weight (kg)	59.72 ± 6.26	60.52 ± 7.15	0.60	0.55
BSA (sqm)	1.62 ± 0.09	1.66 ± 0.19	1.35	0.18
BMI (kg/m <sup>2</sup> )	23.33 ± 3.05	23.70 ± 2.63	0.65	0.52
PR / min.	23.3 ± 3.1	24.2 ± 2.5	1.56	0.12
SBP mmHg	126.8 ± 8.7	124.3 ± 7.9	1.54	0.13
DBP mmHg	80.5 ± 3.8	79.7 ± 3.1	1.10	0.28

All values are expressed as Mean ±SD. (p>0.05 is Not Significant). Analysis of all parameters is done by unpaired t-test

**Table3: Comparison of PFT between sawmill workers and controls**

Parameters	Sawmill workers	Controls	p value
FVC	2.11±0.24	3.25±0.42	p<0.001*
FEV1	1.54±0.25	3.62±0.45	p<0.001*
FEV1/FVC	69.2±12.6	83.8±5.9	p<0.001*
FEF25%-75%	3.85±1.45	4.84±1.03	p<0.001*
PEFR	4.88±2.02	7.24±1.62	p<0.001*
MVV	98.5±25.7	143.4±25.4	p<0.001*

All values are expressed as Mean ± SD. \* indicates highly significant value.

## CONCLUSION

We conclude our study with the findings that chronic exposure to sawdust impairs the lung functions of the workers employed in the mills and predisposes them to develop occupational lung diseases. Workers should be encouraged to make use of protective equipment in order to reduce the deleterious effects of heavy dust exposure.

## ACKNOWLEDGEMENT

First and foremost, we are thankful to the almighty. We also extend our sincere thanks to all the subjects who participated in our study.

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