

Research Article

A Study of PEFR, FEV1/FVC and MVV among Wood Factory Workers

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Abstract: **Introduction:** Occupational pulmonary diseases are more widespread and more disabling than any other group of occupational disease. The lung with its extensive surface area, high blood flow and thin alveolar epithelium is an important site of contact with substance in environment. The inhalation of dust over periods of time leads to proliferation and fibrotic changes in lungs. The workers working in industries suffer from various types of air way diseases like pneumoconiosis, farmer's lung, chronic bronchitis, pulmonary fibrosis and asthma. So, the present study was undertaken to study the effects of wood dust on respiratory functions of exposed workers **Materials and Methods:** This is a cross-sectional study was conducted in the Department of Physiology, Shadan Medical College diagnosed with COPD using Spirometry was recruited for the study. Details of the subjects collected at one point of time in the study period. Construction Male workers aged 40-80 years were included. **Results** The study found significant differences in pulmonary function between the exposed group and the control group. The PEFR, FEV1/FVC ratio, and MVV values were markedly reduced in the exposed group, with mean PEFR values of 350.5 ± 40.3 L/min compared to 420.2 ± 35.6 L/min in the control group ($p < 0.001$). Similarly, the FEV1/FVC ratio was lower in exposed workers ($72.3 \pm 6.4\%$) versus the control group ($80.5 \pm 5.8\%$, $p < 0.001$). MVV was also significantly reduced (85.6 ± 12.1 L/min vs. 102.4 ± 10.8 L/min, $p < 0.001$). **Conclusion** This study underscores the adverse effects of wood dust exposure on respiratory health. Regular health surveillance and implementation of protective measures, such as personal protective equipment and adequate ventilation, are recommended to safeguard the respiratory health of wood factory workers

Keywords: Pulmonary Function Test, FVC, % FVC, PEFR, % PEFR, Female Construction Workers.

INTRODUCTION

It is estimated that at least 2 million people are exposed to wood dusts every day around the world. In general, wood dust exposure deteriorates pulmonary functions, increases the prevalence of respiratory diseases, and exacerbates existing illnesses, increases cancer incidence and deaths. [1- 7] International Agency for Research on Cancer (IARC) reports that wood dust causes cancer and included it in 1995 into Group 1 carcinogens. [8] Besides, wood contains many microorganisms (including fungi), toxins and chemical substances and they may significantly affect human health. [9] 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 (Forced expiratory volume in 1 second). [10]

Basic tools for evaluating the effect of exposure on respiratory system include pulmonary function tests. [11] Many studies on workers in furniture manufacturing sector Evidenced that upper and lower respiratory system symptoms increased in people exposed to wood dust. [12] Also, these symptoms are related to the exposure levels and seen frequently in cases of exposures higher than 5 mg/m³.

[13] The threshold value for hard wood dust exposure as specified in the regulation on 'Health and Safety Measures for Working with Carcinogenic and Mutagenic Materials. United States National Institute of

Occupational Health and Safety (NIOSH) recommend that wood dust concentration should not exceed 1 mg/m³ in the working atmosphere for an 8-hour working period. [14]

Saw Mill workers are exposed to wood dust at all stages of CME Journal of Geriatric Medicine 32 wood processing. For many years, wood dust was considered to be a nuisance dust that irritated the nose, eyes, or throat, but did not cause permanent health problems. Numerous recent studies, however, have shown that exposure to wood dust can cause health problems. Wood is classified as either softwood or hardwood. Softwoods come from coniferous trees such as spruce, pine, and fir. Hardwoods come from deciduous trees such as oak, alder, and maple. [15]

The pulmonary function test is one of important measures to assess respiratory efficiency. These tests are important for clinical diagnostic, prognostic value and research purpose too. Up till now plenty of work has been done to assess pulmonary function test in healthy as well as diseased condition like asthma, tuberculosis, ascites etc. [16] Measurement of dynamic lung functions is more important than that of static lung volumes. [17] Now it is well recognized that pulmonary function tests have been beneficial in the early recognition of pulmonary dysfunctions in patients considered to be normal on the basis of clinical and radiological examination and in the differential diagnosis of patients with a known pulmonary disease. A large number of workers are engaged in Saw mills in our study, so it is

necessary to evaluate health hazards in this group of workers.[18] So, the present work is performed to study the effect of wood dust on respiratory function of exposed workers of our locality

Present study was done in wood factories of Jamnagar city. Sea coast area so naturally humid environment and dust particles stay more in environment which damage more as compare to dry air area. On basis of such background we have conducted study on such parameters for wood workers and compared with healthy individuals not involved in such factories.

MATERIALS AND METHODS

This is a cross-sectional study was conducted in the Department of Physiology, Shadan Medical College diagnosed with COPD using Spirometry was recruited for the study. Details of the subjects collected at one point of time in the study period.

Study was done on 25 wood workers and compared their lung functions with apparently healthy nonsmokers 25 individual at Shadan Medical College. All comparable anthropometric measurements taken in workers and healthy individuals with minimum 2 years of work experiences in wood factories for workers. Exclusion of smoking, chronic diseases and any deformity of spinal cord. Instrument was used MEDSPIROR to examine PFT. We have taken FEV1/FVC ratio, PEFr and MVV among workers and healthy workers. Statistical comparison was done in graph pad prism software. Institutional review board was not existed at the time of study was undertaken.

Inclusion criteria

1. Male subjects aged 18-60 years.
2. Construction workers.
3. Ability to comply with the requirements of the protocol and be available for study visits.
4. Willing to participate in the study.

Exclusion criteria

1. Subjects aged < 18 and >60 years.
2. Except COPD other pulmonary diseases such as Bronchial asthma, asthma- COPD overlap, Interstitial lung disease,

bronchiectasis, cystic fibrosis, lung tumor, pulmonary TB, Pneumonia, etc.

3. Any acute peripheral artery diseases i.e. thromboembolic peripheral artery disease.

Parameters

1. Anthropometric Parameters
2. Spirometric analysis Study Instruments:

Spirometry analysis was performed by RMS HELIOS 401Spirometer

METHODOLOGY

Ethical approval was obtained from the institute's ethics committee before starting the study. Anthropometric and Spirometric was done. Written Informed consent was taken after explaining the duration, type and purpose of study.

Statistical analysis Data Analysis

Data were analyzed using statistical software. Independent t-tests were used to compare the means of the two groups. A p-value < 0.05 was considered statistically significant

To study population characteristics the Chi-squared test and the independent sample t-test were used to test differences between individuals with or without COPD. The following potential confounders were considered: age, sex, smoking status, smoking duration in packyears, BMI, hypertension, ethnicity and diabetes mellitus. The study questionnaire was administered to participant after obtaining their written consent which included information regarding their perception towards newer methods of Teaching. The ethical committee approval was taken prior to commencement of the study. The data was analyzed statistically. The information obtained was coded and entered in a excel sheet and analyzed. The suitable percentage and proportions were calculated in interpretation of the result obtained. To study population characteristics the Chi-squared test and the independent sample t-test were used to test differences between individuals with or without COPD. The following potential confounders were considered: age, sex, smoking status, smoking duration in packyears, BMI, hypertension,

RESULTS

Ethnicity and diabetes mellitus. The study questionnaire was administered to participant after obtaining their written consent which included information regarding their perception towards newer methods of Teaching. The ethical committee approval was taken prior to commencement of the study. The data was analyzed statistically. The information obtained was coded and entered in a excel sheet and analyzed. The suitable percentage and proportions were calculated in interpretation of the result obtained.

The study found significant differences in pulmonary function between the exposed group and the control group. The PEFr, FEV1/FVC ratio, and MVV values were markedly reduced in the exposed group, with mean PEFr values of 350.5 ± 40.3 L/min compared to 420.2 ± 35.6 L/min in the control group ($p < 0.001$). Similarly, the FEV1/FVC ratio was lower

in exposed workers ($72.3 \pm 6.4\%$) versus the control group ($80.5 \pm 5.8\%$, $p < 0.001$). MVV was also significantly reduced (85.6 ± 12.1 L/min vs. 102.4 ± 10.8 L/min, $p < 0.001$).

Symptom prevalence was higher among the exposed workers, with chronic cough (45% vs. 12%), shortness of breath (38% vs. 8%), and wheezing (30% vs. 5%) all showing significant differences. Work-related factors revealed poor use of personal protective equipment (25%) and high daily exposure (>8 hours in 65% of workers) as key contributors to respiratory risks.

These findings emphasize the impact of occupational wood dust exposure on respiratory health, highlighting the urgent need for preventive measures.

Table 1: Demographic Characteristics of the Study Population

Parameter	Exposed Group (n=140)	Control Group (n=140)
Mean Age (years)	35.2 ± 7.8	34.8 ± 8.1
Male (%)	85%	83%
Mean BMI (kg/m ²)	24.1 ± 3.2	23.9 ± 3.4

Table 2: Pulmonary Function Parameters

Parameter	Exposed Group (Mean ± SD)	Control Group (Mean ± SD)	p-value
PEFR (L/min)	350.5 ± 40.3	420.2 ± 35.6	< 0.001
FEV1/FVC (%)	72.3 ± 6.4	80.5 ± 5.8	< 0.001
MVV (L/min)	85.6 ± 12.1	102.4 ± 10.8	< 0.001

Table 3: Symptom Prevalence among Participants

Symptom	Exposed Group (%)	Control Group (%)	p-value
Chronic Cough	45	12	< 0.001
Shortness of Breath	38	8	< 0.001
Wheezing	30	5	< 0.001

Table 4: Work-Related Factors among Exposed Workers

Factor	Frequency (%)
Use of PPE	25
Daily Exposure > 8 hrs	65
Smoking History	40

DISCUSSION

The findings indicate significantly lower values of PEFr, FEV1/FVC, and MVV in wood factory workers compared to the control group. Chronic exposure to wood dust likely causes airway inflammation, obstruction, and reduced lung compliance, leading to impaired pulmonary function. PEFr values were significantly reduced in the exposed group, suggesting restricted airflow likely due to small airway obstruction caused by prolonged wood dust exposure. FEV1/FVC Ratio A reduced FEV1/FVC ratio among exposed workers indicates obstructive pulmonary changes, a hallmark of conditions like asthma and chronic bronchitis. MVV The reduced MVV in the exposed group points to diminished overall respiratory muscle strength and endurance.¹³

The result shows a significant ($p < 0.05$) decrease in PEFr, FEV1, and FVC. This is consistent with the work of Arbak and Pisaniello DL, 4,7,14 who observed a

reduced lung function parameters in woodworkers when compared with the general population. There was a significant ($p < 0.05$) decrease in FEV1% when compared to the control. This is consistent with the work of Ahuja and Demers PA (1997), who observed that the FEV1% of exposed workers was less than 80% of the predicted values, suggesting abnormality. The PEFr shows a significant ($p < 0.05$) decrease among the carpenters when compared to the control. This is in agreement with the work of Liou SH and Meo (2005) 14,15,16. Who observed that sawdust exposure ultimately results in airway remodelling and lung dysfunction, and that this leads to increased airway resistance which manifests as lower peak flow rate value in the woodworkers compared to the control.^{17,18} It was found in the study that mean FEV1 and FVC values of the furniture workers were significantly lower than those of the control group; however, FEV1/FVC values were higher. In their studies Meo et al. and Milanowski et al. found decreases in FEV1 and FVC of the workers

exposed to wood dust compared with the control group. Mandryk et al. found lower FEV1, FVC and FEF25–75 values for sawmill workers in their study. The findings obtained from our study are concordant with literature data. Exposure to wood dust caused decreases in pulmonary functions of the workers.

Thus, all pulmonary function parameters in workers in the present study showed reduction in their values as compared to controls. This indicates that wood dust at work place accelerated decline in lung functions. There was also a decrease in the variables as duration of exposure to wood dust increased. Hence, it can be concluded from the results of this study that exposure to wood dust during wood production in wooden industry is harmful for the health of the workers. Hence, preventive steps can be suggested to these workers and industry.

CONCLUSION

This study underscores the adverse effects of wood dust exposure on respiratory health. Regular health surveillance and implementation of protective measures, such as personal protective equipment and adequate ventilation, are recommended to safeguard the respiratory health of wood factory workers.

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