Research Paper

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A Study on Effects of Wood Dust Exposure on Pulmonary Functions in Carpenters And Non Carpenters of Urban Ahmedabad

Medical Science

KEYWORDS : Wood dust, Occupational exposure, Pulmonary Function tests.

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ABSTRACT

Backgrounds and objectives: The aim of the study is to assess the peak expiratory flow rate, Forced Expiratory Volume in 1 sec (FEV1) and Forced Vital Capacity (FVC) of carpenters and non-carpenters. Material and method: Participants in our study were of two categories: Carpenters (N=50) with minimum 5 years of carpentry in age group of 18-45 years. Control subjects (N=50) with no history of carpentry and in same age group. Physical examination and the pulmonary function tests of the workers were performed. Results: Regarding the

Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 sec (FEVI), (FEV1%), and peak expiratory flow rate, there was a significant decrease (p<0.05) in the carpenters when compared with the non-carpenters. Also, in the anthropometric parameters measured (height, weight, and BMI) there was no significant change in the carpenters when compared with the non-carpenters. Conclusion: In conclusion, the effect of wood dust on carpenters decreases the forced vital capacity, forced expiratory volume in 1 sec and peak expiratory flow rate.

INTRODUCTION

It is estimated that at least 2 million people are exposed to wood dusts every day [1,2] around the world. In general, wood dust exposure deteriorates pulmonary functions, increases the prevalence of respiratory diseases 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 [1].

Besides, wood contains many microorganisms (including fungi), toxins and chemical substances and they may significantly affect human health [1,2, 8–10].

Wood itself has been shown to have the potential to adversely affect the health of woodworkers, resulting in a range of effects from acute irritative symptoms like irritation of oral cavity and throat, tightness of the chest, irritant dermatitis, urticaria, alveolitis and allergies to malignancy and chronic pulmonary illnesses including hypersensitivity pneumonitis and asthma. In addition, woodworkers are exposed to a variety of chemicals, including solvents, adhesives, preservatives, strippers, and finishes, that are used in wood processing and finishing. Depending on their work environment, carpenters may also be exposed to many of the same chemicals used in other industries such as shipbuilding, manufacturing, mining, and construction. In particular, carpenters may be exposed to sawdust during sawing and sanding operations, and to the preservatives, solvents, and asbestos used in finishing. It is recognised that those agents may, deterioration of pulmonary functions, and a reduction of FEV1 [1,2,7,10–15].

Basic tools for evaluating the effect of exposure on respiratory system include pulmonary function tests. Wood workers in well-established industries in developed a well as in developing countries have an increased risk for asthma and other respiratory diseases (Demers *et al)*. Similar observations have been made in a recent study in Africa . In Nigeria, various studies have shown the role of occupational exposure to environmental pollutants in the incidence of respiratory diseases. Cough and sputum production and breathlessness are some of the reported respiratory symptoms of these workers, while occupational asthma and hypersensitivity pneumonitis are recognized clinical syndromes common in such workers. The overall effect of these is a lower level of lung function in these workers. Sawdust (wood dust) is a particulate matter which is composed of fine particles of wood, and is also a source of air pollution. Short term exposure to particulate matter air pollution contributes to acute cardiovascular morbidity and mortality (Brook *et al*., 2004) and exposure to elevated particulate matter level over the long term can reduce life expectancy by a few years. The aims of this study were to estimate occupational exposure to wood dust in the furniture industry and to compare the pulmonary function of workers working in furniture industry with those of controls.

Materials and Methods

The study was conducted on 100 cases after obtaining permission from Institutional Ethics Committee. The subjects, enrolled for the study were informed about the study and procedural details and an informed consent was obtained. The subjects were male carpenters involved in carpentry work for more than 5 years and between the ages of 18 - 45 years. None of the subjects had past history of any major pulmonary disease. Other major clinical illnesses were ruled out by detailed history and careful relevant clinical examination.

Clinical assessment

Detailed history including name, age, socio-economic status, physical activity, hours of working, years of working, dietary history, any addictions, any past/ family history of illness etc. was elicited.

Standard anthropometric measurements: Weight (kg), and Height (cm), were measured on a beam balance. The above parameters were used to calculate the Body Mass index and Body Surface Area was calculated by data of height and weight entered in the computer.

Resting pulse rate and Blood Pressure was measured in sitting position after five minutes of complete rest.

Spirometric pulmonary function testing: MEDI: SPIRO (Medical Equipment and Computer Systems (I) Ltd.) Software was employed for the computer-aided spirometry. Name, age, height, weight, etc. of the subject was entered. This enabled calculation of age and height predicted values calibrated to Indian standards.

The subjects were demonstrated the maneuvers and were allowed rehearsal. After enough practice, subjects performed spirometry to record:

(a) Forced Vital Capacity- expiratory and inspiratory (FVC and

FIVC and its components).
(b) Maximum Voluntary Ventilation

For recording FVC, the subjects were instructed to take a deep and maximum inspiration and breathe out as forcefully as, as fast as and as complete as possible. Graphic records and values of FVC and its components were obtained.

For recording MVV, the subject performed as fast as, as deep as, inspiration and expiration for 10 seconds. The values of MVV per minute were computed.

The data was obtained through ink-jet printer. (All the spirometric values were automatically corrected for BTPS). Computerized spirometry record shows the following parameters:

(a) Forced Vital Capacity (FVC)
(b) Forced Expired Volume in 0.5 seconds ($FEV_{0.5}$)
(c) Forced Expiratory Volume at the end of the 1st second (FEV_1)
(d) Ratio of Forced Expiratory Volume in 1 second and Forced Vital Capacity (FEV_1/FVC)
(e) Peak Expiratory and Inspiratory Flow Rate (PEFR and PIFR)
(f) Forced Expiratory Flow (at 25%, 50%, and 75% of expired volume)
(g) $FEF_{25-75\%}$ (formerly known as MMEFR or Maximum Mid- Expiratory flow Rate)
(h) Forced Inspired Volume at the end of the 1st second (FIV_1)
(i) Forced inspired Vital Capacity (FIVC)

Statistical Analysis
Data was expressed as mean value ± standard deviation and corresponding 95% confidence intervals. Standard deviation has been used to indicate whether the variation of difference of an individual from the mean is by chance.

Unpaired *t* test was used for comparisons between two groups. All hypothesis testing was two-tailed with a significance level of .05. Calculations were performed with GraphPad InStat version 3.00 statistical software.

RESULTS
TABLE1: ANTHROPOMETRIC DATA OF CARPENTERS AND CONTROLS.

	CARPENTERS (N=50) MEAN± SD	CONTROLS (N=50)MEAN± SD	T – test (P value)
AGE (years)	31.73±5.99	30.36±4.97	0.35
HEIGHT (cm)	163.46±7.38	167.5±6.52	0.02*
WEIGHT (kg)	57.4±13.57	59.95±10.09	0.41
BMI (kg/m²)	21.17±3.76	21.19±3.12	0.97
BSA (m²)	1.6±0.2	1.63±0.17	0.53

*** P < 0.05, significant difference**

1. GRAPHICAL REPRESENTATION OF ANTHROPOMETRIC PARAMETERS OF CARPENTERS AND CONTROL GROUP.

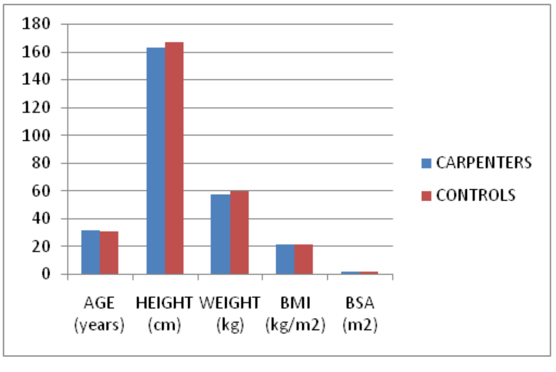
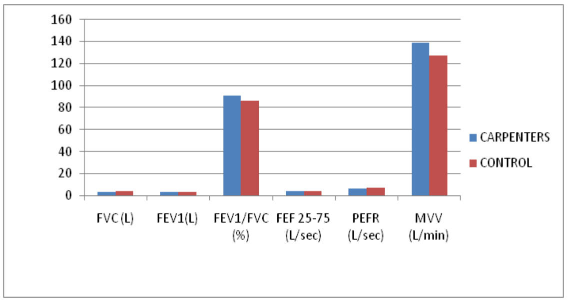


TABLE 2 : COMPARISON OF DIFFERENT PARAMETERS BETWEEN CARPENTERS AND CONTROL GROUP.

PARAMETERS		CARPENTERS (N=50) MEAN± SD	CONTROLS (N=50) MEAN± SD
FVC (L)	OBS	3.31±0.71	3.55±057
	% PRED	97.93±14.52	103.8±16.2
FEV1(L)	OBS	2.84±0.61	3.026±0.45
	% PRED	104.4±16.09	103.3±16.77
FEV1/FVC (%)	OBS	90.52±6.75	85.84±10.83
	% PRED	111.2±9.5	101.63±12.27
FEF 25-75 (L/sec)	OBS	4.12±1.05	3.65±0.73
	% PRED	128±28.59	103.93±30.67
PEFR (L/sec)	OBS	6.24±1.42	7.36±1.46
	% PRED	84.83±17.04	85.7±21.74
MVV (L/min)	OBS	139.19±22.6	127.5±22.82
	% PRED	132.28±17.05	109.93±20.29

2. GRAPHICAL REPRESENTATION OF COMPARISON OF DIFFERENT PARAMETERS BETWEEN CARPENTERS AND CONTROL GROUP.



DISCUSSION
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) [8,10,13]. 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. 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.

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