DOI: 10.7860/JCDR/2013/5568.3231

Original Article

Physiology Section

Effect of Wood Dust on Respiratory Health Status of Carpenters

MAMTA MOHAN[1], APRAJITA[2], NEERAJ KANT PANWAR[3]

ABSTRACT

Introduction: Occupational lung diseases form an important part of clinical medicine. Exposure to various chemicals or toxins which are manufactured or processed in industries are lethal for the workers in industries. Although these chemicals at workplace are known to invariably affect all body systems, lungs are most vulnerable to airborne hazards which are caused due to exposure to wood dust in welding, cement and wood industrial sectors.

Aim and Objectives: The aim of the present study was to establish the effect of wood dust on respiratory health of carpenters and to compare the measured values with those of age-matched controls.

Material and Methods: This study involved 150 non–smoking carpenters, while 150 age–matched healthy non-smoking persons who were engaged in works other than carpentry, served as controls. The influence of age, height, body surface area (BSA) andduration of exposure on peak expiratory flow rate (PEFR) were determined in both cases and control subjects by using a Mini Wright's peak flow meter. The statistical analysis was done by using paired Student's t-test. A p-value of < 0.05 was considered as statistically significant.

Results: The mean PEFR of study subjects was less than that of the control subjects in each sub group of age, height, weight and BSA and these results were statistically highly significant.

Conclusion: The decrease in PEFR in carpenters was probably due to a continuous exposure to wood dust, which had caused an adverse effect on their respiratory status. In order to prevent the ill effects of wood dust on the respiratory health of carpenters, we suggest pre–employment medical check–ups and regular monitoring thereafter. Also, provision for a good ventilation at work place should be made.

Key words: Wood dust, Occupational exposure, Carpenters, Peak expiratory flow rate

INTRODUCTION

An emerging body of research literature has shown a strong association between respiratory health problems and certain occupations [1]. Acute as well as chronic occupational exposures to chemicals have found to be lethal for the workers in industrial plants [2]. Although these chemicals are known to invariably affect all body systems, lungs are most vulnerable to air–borne hazards which are caused due to exposure to wood dust which is produced in sawmills, furniture industries, cabinet making, and carpentry [3]. Studies which had been done earlier have reported that exposure to wood-dust had caused adverse symptoms like cough, malaise, chest pain, dyspnoea and headache in wood workers [4]. A few studies have commented on the role of wood-dust in inducing occupational asthma, chronic bronchitis, pnuemonitis, nasopharyngeal and lung malignancies, but data is relatively inconclusive [5].

Many researchers have observed a reduced PEFR (Peak Expiratory Flow Rate), a forced vital capacity (FVC) and a forced expiratory volume in first second (FEV_1) in wood workers as compared to those in general population [6]. In view of a dearth in information on this issue, it was necessary to carry out the present research as a detailed study, on effects of wood dust on peak expiratory flow rate (PEFR), which were caused by work exposure, which was lacking in this geographical region.

The aim of present study was to know the values of PEFR in healthy, non-smoking carpenters and the influence of age, height, weight, body surface area and duration of exposure on these PEFR values and to compare these values with those of healthy non–smoking persons who were engaged in works other than carpentry.

MATERIAL AND METHODS

This study was conducted in the Department of Physiology, Rajindera Medical College, Patiala, India. The subjects comprised of 150 randomly selected, male carpenters who were in the age group of 18–45 years. Their ages, smoking habits, duration of exposure, physical status and health conditions were recorded by using a questionnaire. After recording their brief history, they were examined as per the proforma, which was attached. The ethical committee's clearance and informed consents of the subjects were obtained.

Healthy persons with a previous history of respiratory illnesses and persistent cough or expectoration and smokers were excluded from this study, because smoking is a more important cause of respiratory symptoms and reduction in the ventilatory capacity than wood dust. The study group was divided into two different groups i.e. Group A and Group B on basis of their profession. Group A (study subjects) consisted of 150 healthy, non-smoking carpenters who were working in Patiala District. Group B (control subjects) consisted of 150 healthy, non–smoking persons who were engaged in works other than carpentry.

Further, study and control subjects were categorized according to their age, height, weight, body surface area and duration of exposure to wood dust. PEFR was determined by using a Mini Wright's peak flow meter. The testing procedure was quite simple and non–invasive and it was harmless to the patients. It was explained to subjects, followed by a demonstration of its performance. The test was done with the subjects in standing position. The subjects were instructed to take a maximal inspiration and to blow into the instrument rapidly and forcefully. A close watch was made to ensure that a tight seal was maintained between the lips and mouthpiece of the device. The test was repeated 3 times and the highest of these readings was considered for the purpose of analysis as litre/min. All the observations of age, height, weight, body surface area and PEFR were recorded in the proforma.

The data was analysed by using the computer softwares, Microsoft

Excel and Statistical Package of Social Sciences (SPSS, version 15.0). The mean and standard deviation (SD) were calculated and reported for the quantitative variables. The statistical difference in the mean values was tested by using Student's t-test. A p-value of < 0.05 was considered as statistically significant.

OBSERVATIONS AND RESULTS

[Table/Fig-1] shows the mean and standard deviation of PEFR in study and control subjects. Mean PEFR of study subjects was less than that of the control subjects and this difference was statistically significant (p<0.01).

Subjects	Range of PEFR (in Lts./min.)	Mean ± SD of PEFR (in Lts./min.)	't' value	'p' value
Study	300 – 490	393± 52.14	16.44	<0.01
Control	390 – 570	485.53±45.10		

[Table/Fig–1]: Comparison of Mean and SD of Pefr in Study and Control Subjects Groups

[Table/Fig-2] shows the mean ± standard deviation of PEFR in study and control subjects according to the three age groups. Mean PEFR of study subjects was less than that of the control subjects in all 3 groups and this difference was statistically significant (p<0.01).

[Table/Fig-3] shows the mean and standard deviation of PEFR in study and control subjects according to three height intervals. Mean PEFR of study subjects was less than that of the control subjects in each height interval and it was statistically significant (p<0.01).

[Table/Fig-4] shows the mean and standard deviation of PEFR in study and control subjects according to three weight intervals. Mean PEFR of study subjects was less than that of the control subjects in each weight interval and it was statistically significant (p<0.01).

[Table/Fig-5] shows the mean and standard deviation of PEFR in study and control subjects according to three body surface area sub groups. Mean PEFR of study subjects was less than that of the control subjects according to BSA in each sub- group and it was statistically significant (p<0.01).

[Table /Fig-6] shows the mean and standard deviation of PEFR in study subjects according to three duration of exposure groups in the study subjects. Mean PEFR decreased with an increase in duration of exposure in study subjects.

DISCUSSION

The present study was undertaken to establish the effect of wood dust on the respiratory health status of carpenters by measuring their peak expiratory flow rate (PEFR) values. Cases consisted of 150 non-smoking carpenters who were in age group of 18-45 years, while 150 non -smoking persons who were engaged in works other than carpentry served as controls. The observations were analysed statistically. Comparison of PEFR in study and control subjects was done and data was collected. Also influence of age, height, weight, body surface area and duration of exposure on PEFR of carpenters was studied. Prediction equations were formulated to determine PEFR.

PEFR is the largest expiratory flow rate which is achieved with a maximal forced effort from a position of maximal inspiration, which is expressed in litres/min. Since it can be easily carried out at work place, this parameter is often used to detect the severity of lung diseases.

PEFR and Age: In the age group of 18–27 years, mean PEFR was found to be 495.31 ± 45.42 litres/min, which declined with age to reach values of 486.38 ± 46.13 litres/min (for age group of 28-36 yrs) and 475.93 ± 42.67 litres/min (for age group of 37-45 years) [Table/Fig-2]. Therefore, the present study revealed that mean PEFR in study subjects decreased with an increase in age. Also, when mean PEFR of study subjects was compared with that of control subjects according to three age sub–groups, it was found to be less than that of control subjects and this difference was statistically highly significant. The results were consistent with those of another study which was conducted [6].

PEFR and Height: As shown in [Table/Fig-3],there was a positive correlation between PEFR and height in the control subjects (r=+0.269). The mean PEFR in study subjects and control subjects increased with an increase in height. This result was corroborative

Age groups (in years)	Study		Control		't' value	'p' value
	No. of subjects	Mean ± SD of PEFR (in Lts./min.)	No. of sub.	Mean ± SD of PEFR (in Lts./min.)		
18-27	47	429.36 ± 40.72	49	495.31 ± 45.42	7.48	<0.01
28-36	57	383.33 ± 47.97	47	486.38 ± 46.13	11.09	<0.01
37-45	46	367.83 ± 47.93	54	475.93 ± 42.67	11.93	<0.01

[Table/Fig-2]: Comparison of Mean and SD of Pefr in Study and Control Subjects According to Age Groups

Height intervals (in cms)	Study		Control		't' value	'p' value
	No. of subjects	Mean ± SD of PEFR (in lts./min.)	No. of sub.	Mean ± SD of PEFR (in lts./min.)		
<155	36	383.61 ± 50.55	54	473.89 ± 42.22	9.18	<0.01
156 – 168	84	381.43 ± 46.20	61	487.21 ± 41.68	14.17	<0.01
>169	30	436.67 ± 48.02	35	500.57 ± 51.16	5.16	<0.01

[Table/Fig-3]: Comparison of Mean and SD of Pefr in Study and Control Subjects According to Height Groups

Weight intervals (in kgs)	Study		Control		't' value	'p' value
	No. of sub.	Mean ± SD of PEFR (in Lts./min.)	No. of sub.	Mean ± SD of PEFR (in Lts./min.)		
<54	45	392.44±47.63	32	483.75±46.96	8.34	<0.01
55 – 69	85	383.65±50.35	88	479.32±43.70	13.66	<0.01
>70	20	434.00±51.95	30	505.67± 42.72	5.33	<0.01

[Table/Fig-4]: Comparison of Mean and SD of Pefr in Study and Control Subjects According to Weight Groups

BSA groups (in m²)	Study		Control		't' value	'p' value
	No. of sub.	Mean ± SD of PEFR (in lts./min.)	No. of sub.	Mean ± SD of PEFR (in lts./min.)		
<1.55	53	385.85 ± 48.45	45	472.67± 43.24	9.28	<0.01
1.56– 1.80	80	387.5 ± 50.40	80	486.25 ± 45.46	13.01	<0.01
>1.81	17	441.18 ± 48.59	25	506.4 ± 40.4	4.73	<0.01

[Table/Fig-5]: Comparison of Mean and SD of Pefr in Study and Control Subjects According to Body Surface Area

Group No.	Duration of exposure (in years)	No. of subjects	Range of PEFR(in lts./min.)	Mean ± SD of PEFR (in lts./min.)
1.	1 – 5	50	300 – 490	430.8 ± 39.48
2.	6-10	77	300 – 490	384.16 ± 47.61
3.	11-15	23	300 – 390	340.43 ±26.54

[Table/Fig-6]: Comparison of Mean and SD of Pefr in Study Subjects According to Duration of Exposure Groups

with those of the studies which were conducted by researchers [7]. On comparison, according to three height sub–groups, mean PEFR of study subjects was found to be less than that of control subjects and this result was statistically highly significant.

PEFR and Weight: In this study, there was a positive correlation between PEFR and weight in study group (r=+0.224) and controls (r=+0.224), which meant that the mean PEFR in study subjects and control subjects increased with an increase in weight. This observation was in accordance with that of other study [8]. Moreover, when mean PEFR of study subjects was compared with that of control subjects according to three weight sub groups, it was found to be less than that of control subjects, which was found to be highly significant [Table/Fig-4].

PEFR and Body Surface Area: The mean PEFR in study subjects and control subjects increased with an increase in body surface area, as shown in [Table/Fig-5]. Our finding was in accordance with those of other studies [9]. When mean PEFR of study subjects was compared with that of control subjects according to three body surface area sub groups, it was found to be less in study subjects than in control groups, which was found to be highly significant.

PEFR and duration of exposure: The present study revealed that mean PEFR in study subjects decreased with an increase in duration of exposure to wood dust, as shown in [Table/Fig-6]. This observation was consistent with that of another study [10] and it was found to be statistically significant(p<0.01).This was probably due to adverse effects of wood dust on respiratory status of carpenters.

CONCLUSION

The mean PEFR of study subjects was less than that of the control subjects in each sub group of age, height, weight and BSA and these results were statistically highly significant. The decrease in PEFR in carpenters was probably caused by a continuous occupational exposure to wood dust, which had caused an adverse effect on their respiratory functions. His/her working conditions are important for a person's respiratory health.

Mostly, all the carpenters work in confined spaces without protective devices. In order to prevent the ill effects of wood dust on the respiratory health of carpenters, we suggest a medical observation which includes pre-employment medical check-ups, provision for a good ventilation at work place and encouragement on use of personal protective equipment like masks. Further regular lung monitoring should be done to detect any ill effects on respiratory system at an early age and to prevent spread of the disease.

REFERENCES

[1] Aguwa EN, Okeke TA, Asuzu MC. The prevalence of occupational asthma and rhinitis among wood workers in south eastern Nigeria. *Tanzania Health Research Bulletin*. 2007; 9(1):52-55.

[2] Tanko Y, Olakunle Y, Jimoh A, Mohammed A, ADT Goji, KY Musa. Effect of wood dust on cardiopulmonary functions and anthropometric parameters of Carpenters and Non carpenters in Sabon Gari Local Environment Area, Kaduna state, Nigeria. *Asian Journal of Medical Sciences*. 2011; 3(1):43-46.

[3] MeoSA. Effect of duration of exposure to wood dust on peak expiratory flow rate among workers in small scale wood industries. *Int J Occup Med Environ Health*. 2004; 17(4):451-55.

[4] Liou SH, Cheng SY, Lai FM, Yang JL.Respiratory symptoms and pulmonary function in mill workers exposed to wood dust. *Am J Ind Med*. 1996; 30(3):293-99.

[5] Ricciardi L, Fedele R, Saitta S, Tigano V, Mazzeo L, Fogliani O, et al. Occupational asthma due to exposure to iroko wood dust. *Ann Allergy Asthma Immunol*. 2003; 91(4):393-97.

[6] Jain SK, Kumar R, Sharma DA. Peak expiratory flow rates in healthy Indian adults: A statistical evaluation-1. *Lung India*. 1983; 3(1):88-91.

[7] Elebute EA, Femipearse D. Peak flow rate in Nigeria : Anthropometric determinants and usefulness in assessment of ventilatory function. *Thorax*. 1971; 26:597-601.

[8] Woolcock AJ, Colman MH, Blackburn CRB. Factors affecting normal values for ventilatory lung function. *Amer Rev Resp Dis*. 1972; 106:692-709.

[9] Sherif M, Mukhtar R, Rao GMM, Morghom LO. Peak expiratory flow rates in Libyan adolescents. *Indian J Physiol Pharmacol*. 1989; 33(4): 223-27.

[10] Shamssain MH. Pulmonary function and symptoms in workers exposed to wood dust. *Thorax*. 1992; 47(2):84-87.

PARTICULARS OF CONTRIBUTORS:

1. Senior Resident, Department of Physiology, University College of Medical Sciences, Dilshad Garden, New Delhi, India.
2. Senior Resident, Department of Physiology, Maulana Azad Medical College, New Delhi, India.
3. Senior Lecturer, Department of Pedodontics and Preventive Dentistry, IDST Dental College & Hospital, Kadrabad, Ghaziabad, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Mamta Mohan,
49 C, F–Block , Dilshad Garden, New Delhi, India.
Phone: 8377037372, E-mail: mamtamohan16@yahoo.in

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: Jan 04, 2013
Date of Peer Review: May 27, 2013
Date of Acceptance: Jun 11, 2013
Date of Publishing: Aug 01, 2013