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A CROSS-SECTIONAL STUDY OF PEAK EXPIRATORY FLOW RATE IN CARPENTERS OF NORTH-EAST INDIA

Physiology

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ABSTRACT

INTRODUCTION : Wood dust is a by-product of cutting, grinding, or drilling wood .Wood dust exposure deteriorates pulmonary function .

AIMS AND OBJECTIVES: To study peak expiratory flow rate(PEFR) in carpenters and to compare the values with healthy normal people.

MATERIAL AND METHODS: The present study was done in guwahati city on 100 carpenters who were exposed to wood dust and 100 healthy normal individuals never exposed to wood dust. Healthy non-smoker males,within the age group of 20-40 years were studied. PEFR values were calculated using Medspiror. Statistical analysis was done using unpaired t-test keeping $p < 0.05$ as level of significance and data reported as Mean ± Standard Deviation.

RESULTS: The mean PEFR values were found significantly lower in study group compared to the control group, p value is < 0.01 and is considered highly significant.

CONCLUSION: Chronic wood dust exposure in carpenters decreases PEFR. So,periodic respiratory examination, health education and preventive measures must be adopted to ensure better health outcome.

KEYWORDS

Wood Dust, PEFR

INTRODUCTION

Industries have been established since the time of civilization to meet the demand of humans. Some of the industries were found to lead to unwanted effects on human health.[1]An emerging body of research literature has shown a strong association between respiratory health problems and certain occupations.[2] One of the basic exposure and occupational hazard factors is dust.[3]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.[4]

Sawdust or wood dust is composed of fine particles of wood produced as a result of cutting, grinding, drilling, sanding wood with a saw or other tool.[5] Wood dust exposure decreases pulmonary function and increases the prevalence of respiratory diseases.[6]Wood contains fungi, toxins and chemical substances which may significantly affect human health.[7]

Saw-mill workers are reported to have clinical symptoms like dry cough, shortness of breath, chest pain, dermatitis, conjunctivitis, asthma, febrile reaction, lung fibrosis, rhinitis, headache, allergic alveolitis and chronic obstructive lung disease.[8]

Spirometry helps clinicians to have vital information about patients having lung disease.[9]Many researchers have found 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 when compared to general population.[10]

Even though several studies on wood dust exposure have been conducted throughout the world, not many studies have been done on this population in guwahati, a city in assam of north-east India. Therefore, a detailed study was necessary to be carried out in this particular region on the effects of wood dust exposure.

The aim of the present study is to know the values of peak expiratory flow rate (PEFR) in carpenters and influence of duration of exposure on this PEFR values and to compare the values with healthy normal people.

MATERIAL AND METHODS

The present study is a cross-sectional (comparative) study which was conducted during the period from may 2014 to September 2015 in guwahati city. Before starting the study, ethical clearance was taken from institutional ethics committee. As the number of female workers working as carpenters are few only male workers were selected for the study.

Permission was taken from in-charge of carpentry workshop before performing the tests. Subjects were explained in brief why the study was done and only co-operative subjects were taken for the study. Detailed history and clinical examination of every subject was taken according to standard proforma. In the standard proforma particulars such as age, height, weight, duration of work, smoking habits and history of any respiratory or other illness in the past or present were recorded.

The study group comprised of 200 non-smoker males of which 100 were carpenters who were exposed to wood dust and 100 were healthy normal individuals never exposed to wood dust within the age group of 20-40 years. Persons having history of smoking, allergy, cardiac or respiratory dysfunctions were excluded from the study. Duration of service was more than 1 year with 8 hours of work per day.

The study group was again divided into two subgroups consisting of 50 carpenters with 1-5 years of exposure and the second group of 50 carpenters with more than 5years of exposure. Upto 10 years duration of exposure was taken.

Data collection technique

The anthropometrical parameters such as age in years, height in cm, and weight in kg were measured. Weight was measured using a weighing scale. Height was measured using the Anthropometer that consists of a foldable, graduated (0-200) cm, vertical rod and a horizontal adjustable graduated bar (1-25) cm.

PEFR was recorded using an expirograph, Medspiror (Recorders and medicare systems pvt. ltd) which is an electronic device for measurement of lung function parameters. The subjects were explained about the whole manoeuvre and a practical demonstration of its performance was done. Proper history was taken and all parameters like name, age, height, weight, sex were entered. They were asked to close their nostrils and take maximum inspiration . The subjects were then asked to fix his lips on the mouthpiece of the Medspiror, make an airtight seal and after that asked to blow into the mouthpiece as forcibly and fast as possible. The test was performed with the subject in standing position using nose clips. When the subject was able to do as practised, a print of the record was taken by pressing print key of the machine. This procedure was repeated 3 times and the best result was considered for analysis.

Statistical Analysis

Statistical analysis was done using student t-test (unpaired t-test).Significance was set at $p<0.01$ and $p<0.05$ and data reported as Mean ± Standard Deviation. All statistical analysis were performed using Graph Pad Instat.

RESULTS AND OBSERVATIONS

The study comprised of a total sample of 200 with 100 carpenters as the subject group and 100 non-carpenters as the control group.

The important results and observations found during the course of the study are as follows.

Table 1: Number of subjects and Control group

Group	No.	%
Subject	100	50%
Control	100	50%

Interpretation:
Table 1 shows that out of 200 samples, 50% are in the subject group (carpenters) and the rest 50% are in the control group (non-carpenters)

Table 2: Comparison of the PEFR (litre/min) among the Subject and Control group

Group	Mean	SD	d.f.	t-value	Significance
Subject	425.00	46.85	198	4.869*	p<0.01
Control	449.98	20.90			

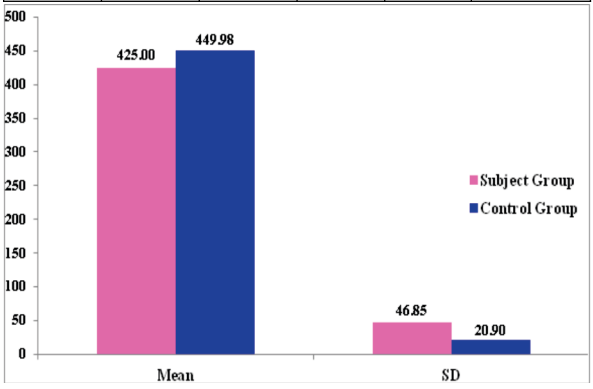

Figure 1:Graph showing the mean & SD-values of parameter PEFR (Litre/Min) among the subject and control groups

Interpretation: Table 2 and Figure 1 shows that the subject group had lower mean score of PEFR than the control group. Students unpaired t-test was applied and it was found that there is a significant difference in PEFR between the subject and control group at 0.01 level of significance (p<0.01) .

On the basis of the duration of exposure, the subjects having exposure of 1-5 years, are categorised as group A and the subjects who have exposed >5 years, are categorised as group B.

Table 3: Comparison between PEFR values among group A and group B

Parameters	Group A (N=50) exposure (1-5 yrs) Mean± SD	Group B (N=50) exposure (>5 yrs) Mean ± SD	(d.f.)	t-value	Significance
PEFR (Litre/mint)	445.58 ± 45.41	404.42 ± 38.85	98	4.870*	p<0.01

(d.f.→ degree of freedom.*→ significant. The critical value or p-value for 50+50-2 = 98 d.f. at 0.01 is **2.63**)

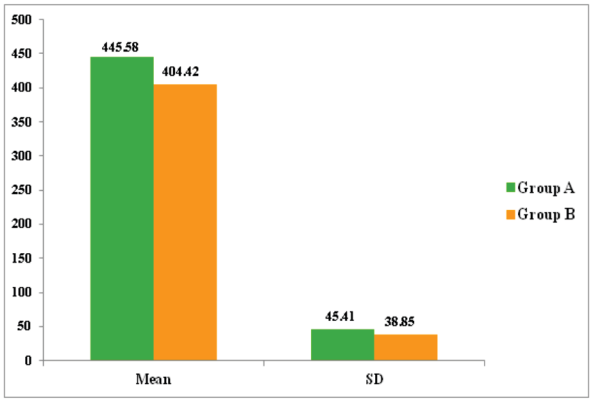

Figure 2: Graph showing the mean & SD values of PEFR (Litre/min) among the subjects according to their duration of exposure

Interpretation: The mean PEFR in group B has been found to be lower than group A. Mean distribution in the group A is 445.58 ± 45.41; while the same is 404.42 ± 38.85 in group B. So, PEFR is found higher in the carpenters who have been exposed for 1- 5 years; while the same is lower in the carpenters who have been exposed for more than 5 years.

DISCUSSION

In the present study an attempt was made to study the peak expiratory flow rate of carpenters exposed to wood dust and the effect was compared with that of non-carpenters.The study group consisted of 100 non-smoking male carpenters and control group consisted of 100 non-smoking male healthy adults never exposed to wood dust(non-carpenters).The study group was further divided into 50 carpenters with 1-5 years of exposure and another 50 carpenters with more than 5 years of exposure.

In the study undertaken, the mean values of PEFR between both the groups showed statistically significant difference (p<0.01), as the values were found (425.00±46.85) litres/minute for subject group and (449.98± 20.90) litres/minute for control group.

The subjects were further subdivided into two groups on the basis of duration of exposure : group A (1-5 yrs) and group B (> 5 yrs).Mean values of PEFR of group A was found to be (445.58 ± 45.41)litres/min and that of group B was found to be (404.42 ± 38.85)litres/min. PEFR of group A(1-5yrs) was found to have significant difference (p < 0.01) with that of group B(>5yrs).

The results of this study are in agreement with earlier studies relating to pulmonary function with occupational exposure to wood dust.The similar studies of different workers in different parts of the world are as follows:

Ihekwaba et al(2009), showed a significant exposure-dependent decrease in PEFR values for sawmill workers as compared to controls, stating that they are vulnerable for developing occupational lung diseases.[11]

In a study done by Purushottam Pramanik and Archana Chaudhury (2013) , there was a significant decrease in lungs volume viz. forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV_1) while ratio of FEV_1/FVC was normal.Pulmonary flow rate was significantly reduced including peak expiratory flow rate (PEFR) and Maximal mid expiratory flow rate $FEF_{(25-75\%)}$ .Thus it was summarised that, wood dust exposure harmfully affects lung function.[1]

Mamta Mohan, Aprajita and Neeraj Kant Panwar (2013) did a study where in the results it appeared that the mean PEFR of subjects was significantly less than that of the control subjects in each sub group of age, height ,weight and BSA.[2]

In another study done by Yogesh Kacha, Yagnesh Nayak et al(2014), the mean values of FVC, FEV_1, $FEF_{25\%}$, SVC, PEFR, $FEF_{50\%}$ and MVV were significantly lower in saw mill workers as compared with their predicted value.The decrease in FVC and MVV indicates a restrictive impairment whereas decrease in FEV_1, $FEF_{25-75\%}$, PEFR indicates an obstructive impairment. Inhalation of wood/saw dust is associated with a reduction in pulmonary function and it further decreased with greater duration of exposure.[12] Kherde *et al* did a study (2016) where it was concluded that mean PEFR values in the sawmill workers were significantly lower than in controls and as the duration of exposure goes on increasing, the PEFR goes on decreasing. [8]

In another study done by Pandarikkal JR *et al* (2018), a statistically significant reduction was seen in SVC, FVC, FEV_1, PEF, and $FEF_{25-75\%}$ compared to healthy adults.Those with maximum duration of exposure were having maximum dysfunction.[13]

The reduction in PEFR in sawmill workers might be due to inflammatory changes in the respiratory tracts which lead to increased airway resistance as a result of the sawdust exposure which brings about the remodeling of the airway; hypertrophy of mucosal cells leading to increased secretions of mucus and formation of mucosal plugs which cause obstruction to the exhaled air and consequently lung dysfunction.[8]

Decreased lung capacity is caused by mechanical or chemical irritation of lung tissue by the dust, which causes the airways to narrow,reducing the volume of air taken into the lungs and producing breathlessness.It usually takes a long time to see a reduction in lung capacity.[14]

Further wood dust also contains contaminants such as fungal spores and other microbials, wood preservatives, coatings, sealants and glues (e.g. formaldehyde, pentachlorophenol, glycols, copper naphthanate) etc.[15],which are toxic to human health.

CONCLUSION

In the present study, it was seen that peak expiratory flow rate (PEFR) was significantly reduced in carpenters as compared to control group. It can be concluded that the mechanical and chemical irritation due to wood dust exposure causes inflammatory changes leading to increased airway resistance and hypersection of mucus causing obstruction and decrease in lung function.The health risk could be reduced by the mutual collaboration between health officials, management of the furniture industries and their workers by the adoption of certain protective measures such as by educating the workers about the harmful effects and its prevention, use of exhaust ventilation system, encouragement for use of masks, protective clothing and gloves, and periodic respiratory examination should be done which will lead to better health outcome and thus better work performance.

REFERENCES

(1) Pramanik P ,Chaudhury A. Impact Of Occupational Exposure To Wood Dust On Pulmonary Health Of Carpenters In Small Scale Furniture Industries In West Bengal. DHR-IJBLS, Vol. 4, Issue 1, 2013. ISSN: 2278-8301
(2) Mamta M, Aprajita, and Neeraj Kant P. Effect of Wood Dust on Respiratory Health Status of Carpenters. J Clin Diagn Res. 2013 Aug; 7(8): 1589–1591.
(3) S. Baran,I.Teul. Wood dust: an occupational hazard which increases the risk of respiratory disease. Journal of physiology and pharmacology. 2007, 58, Suppl 5, 43-50
(4) MeoSA. Effect of duration of exposure to wood dust on peak expiratory flow rate among workers in small scalewood industries. Int J Occup Med Environ Health.2004;17(4):451–55.
(5) www.wikipedia.org/ https://en.wikipedia.org/wiki/Sawdust
(6) Erdinc O, Kayihan P. Int J Occup Med Env Health, 2009; 22(1): 43-50.
(7) Pandarikkal JR et al. Int J Res Med Sci. 2018 Oct; 6(10):3418-3422
(8) Kherde PM, Mishra NV, Chitta SS, Gahukar SD. Influence of sawdust on peak expiratory flow rate in sawmill workers of central India working in unprotected environment and its correlation with duration of exposure. Natl J Physiol Pharm Pharmacol 2017;7(1):68-73.
(9) Godfrey S, Baum JD, Clinical Pediatric Physiology, Blackwell Scientific Publication 1979, Respiration, Chapter 7, pg 250-251
(10) 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.
(11) Ihekwaba AE, Nwafor A, Adienbo OM. Lung function indices in primary and secondary sawmill workers in port harcourt, Nigeria. Afr J Appl Zool Environ Biol. 2009;11:101-5.
(12) Kacha Yogesh, Anup Vegad , Varu Maulik , Mehta Hemant ,Shah, C J .Effects of wood dust on respiratory functions in saw mill workers.IJBAP, Vol 3(1) 2014:122
(13) Pandarikkal JR et al. Int J Res Med Sci. 2018 Oct;6(10):3418-3422
(14) Health Effects From Exposure to Wood Dust.Workplace health and safety bulletin. CH045- Chemical Hazards 1 Revised August 2009.
(15) M.S. Usman. Effect of Duration & Severity of Exposure on Peak Expiratory Flow Rate Among Workers Exposed to Wood Dust in Central India (Nagpur).International journal of scientific research.Volume :2/Issue:10/October 2013:ISSN NO.2277-8179.