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A CROSS-SECTIONAL STUDY OF THE INFLUENCE OF WOOD DUST ON FORCED EXPIRATORY FLOW DURING 25% - 75% OF EXPIRATION IN CARPENTERS.

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ABSTRACT **INTRODUCTION:** Wood dust is produced when machines are used to cut or shape wood materials. Wood-related risks are the health hazards with the toxic, allergenic, and carcinogenic products which may alter respiratory function. **AIMS AND OBJECTIVES:** To study forced expiratory flow 25-75% ($FEF_{25-75\%}$) in carpenters and to compare the values with healthy normal people (non-carpenters). **MATERIAL AND METHODS:** The study was conducted on 200 non-smoker males of which 100 were carpenters having minimum 1 year duration of service and 100 were healthy normal individuals never exposed to wood dust selected from guwahati city in the age group of 20 - 40 years. $FEF_{25-75\%}$ was calculated using medspiror. **RESULTS:**Mean $FEF_{25-75\%}$ value was found significantly lower in study group than the control group. It was found $p<0.01$ and is highly significant. **CONCLUSION:**Chronic wood dust exposure decreases $FEF_{25-75\%}$ value in carpenters.

KEYWORDS : Wood dust, $FEF_{25-75\%}$, Carpenters

INTRODUCTION

Wood dust is one of the most common occupational exposures, which is harvested in almost all countries for its traditional use for fuel and construction material, and it is found to contribute for respiratory problems among exposed workers globally[1]. It is estimated that at least 2 million people are exposed to wood dust every day around the world[2].

Several studies have highlighted the link between wood dust exposure and ventilatory disorders[3,4].Many studies on workers in furniture manufacturing sector evidenced that upper and lower respiratory system symptoms increased in people exposed to wood dust[5] .Industries that have a high risk of wood-dust exposure include sawmills, dimension mills, furniture industries,cabinet makers, and carpenters[6].

Basic tools for evaluating the effect of exposure on respiratorysystem include pulmonary function tests[7].$FEF_{25-75\%}$ is one of the most effort independent portion of the curve, more sensitive parameter to airflow in peripheral airways, where disease of chronic airflow obstruction can begin[8]. Although the forced expiratory volume in one second (FEV_1) and the FEV_1 to forced vital capacity (FVC) ratio are the most commonly used spirometric parameters for identification of both the presence and degree of airflow obstruction, other values such as the forced expiratory flow between 25% and 75% of the FVC ($FEF_{25-75\%}$) are also commonly reported[9]. $FEF_{25-75\%}$ is the forced expiratory flow at 25% – 75% of lung volume. It indicates the patency of small airways[10]. Therefore the present study aims at studying the Pulmonary function test parameter $FEF_{25-75\%}$ in carpenters and comparing the value with healthy normal people.

MATERIAL AND METHODS

The study was conducted on 200 non-smoker males of which 100 were carpenters exposed to wood dust and 100 were healthy normal individuals never exposed to wood dust selected from guwahati city. The age group was 20 – 40 years. Ethical clearance was taken from the institutional ethics committee before start of the study. Subjects with history of smoking, any allergy, cardiac or respiratory illness were excluded from the study. Carpenters having minimum 1 year duration of service and 8 hours of work per day were taken in the study. Detailed history taken and clinical examination of every subject was done. Only male workers were selected as subjects for the study.

The subjects were divided into two groups according to their duration of service viz.,Group - A consisting of 50 carpenters (duration of service 1-5 years); Group-B consisting of 50 carpenters (duration of service >5 years). Duration of service of upto 10 years was considered for the study.

Anthropometric data such as age in years, height in cm and weight in kg were recorded. Weight was measured using weighing machine and height was measured using an anthropometer.

Forced expiratory flow between 25% and 75% of FVC ($FEF_{25-75\%}$) was measured using an expirograph, Medspiror (Recorders and medicare systems pvt. ltd). A detailed explanation of the procedure and a practical demonstration was done before starting. Then all the data such as name, age, height, weight, sex were entered in the medspiror. The subjects were asked to fit the mouthpiece of the medspiror into their mouth and instructed to seal their lips around the mouth piece.To avoid nasal expiration, nose clip was used. They were instructed to take maximum inspiration followed by blowing out of air into mouthpiece as hard and as fast as possible till they could not breath out any more air. After completion of the whole procedure, a print of the record was taken. Three trials for each subject were given and the best of the three value was recorded.

Analysis of data

To test the significance of difference student t-test (unpaired t-test) was applied. The data analysis were done using Graph Pad Instat. Data was expressed as Mean ± Standard Deviation and significance level was set at $p<0.01$ and $p<0.05$.

RESULTS AND OBSERVATIONS

The study group comprised of 100 male carpenters and control group comprised of 100 male healthy adults never exposed to wood dust (non-carpenters).

Table 1: Comparison of the parameter $FEF_{25-75\%}$ (Litre/Sec) among the Subject and Control group

Group	Mean	SD	d.f.	t-value	Significance
Subject	3.60	0.40	198	6.581*	p<0.01
Control	3.95	0.34			

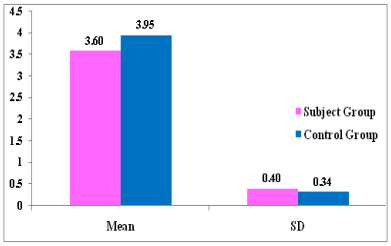

Figure 1:Graph showing the mean & SD-values of parameter $FEF_{25-75\%}$ (Litre/Sec) among the subject and control groups.

Interpretation:. Table 1 and figure 1 shows that the control group i.e. the non-carpenters have higher mean score of the parameter $FEF_{25-75\%}$(Litre/Sec) than their subject group i.e.the carpenters. To test whether this difference is statistically significant or not, Student's unpaired't'-test was applied. It has been found that the difference is statistically significant at 0.01 level as $p<0.01$.

According to the duration of service subjects were divided into Group A with 1-5 years duration of service and and subjects who had >5 years duration of service were categorised as Group B.

Table 2:Mean distribution of $FEF_{25-75\%}$ among group A & group B& their 't'-values

Parameter	Group A(N=50) Mean± SD	Group (N=50) Mean ± SD	(d.f.)	t-value	Significance
$FEF_{25-75\%}$ (Litre/Sec)	3.76±0.32	3.45±0.43	98	4.018*	p<0.01

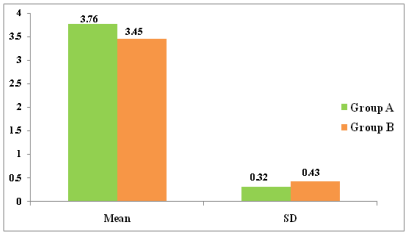

Figure 2: Graph showing the mean & SD values of $FEF_{25-75\%}$(Litre/Sec) among the subjects according to their duration of exposure.

Interpretation: Table 2 and Figure 2 have depicted that the mean score of the parameter $FEF_{25-75\%}$(Litre/Sec) in group A is higher than group B. Mean distribution in the group A is 3.76 ± 0.32; while the same is 3.45 ± 0.43 in group B and their difference is statistically significant.

DISCUSSION

In the study undertaken, it is seen that mean value of $FEF_{25-75\%}$declined significantly (p<0.01) in study group compared to the control group. Further,on the basis of duration of service, study group was further subdivided into two groups - Group A(1-5 yrs of service) and Group B(>5 yrs of service). Mean value of $FEF_{25-75\%}$showed significant decline (p<0.01) in Group B compared to the Group A.

These findings are consistent with the works of several researchers on effect of wood dust exposure on pulmonary function.Mandryk et al.found lower FEV_1, FVC and $FEF_{25-75\%}$ values for sawmill workers in their study[11]. Liou et al. found lower $FEF_{25-75\%}$values for both smokers and non-smokers exposed to wood dust compared with the control group in their study conducted in Taiwan[12].

In another study done by Mbengue et al. negative correlations were found between the duration of exposure and forced expiratory volume in 1 s (FEV_1), FEV_1/forced vital capacity, and $MEF_{25-75\%}$[13].In addition, Whitehead et al. in their study found that MEF is 2–4 times lower with exposure to softwood or hardwood dust at >10 mg-years/m^3[14].

Chatterjee et al. found that FVC, FEV1, $FEF_{25-75\%}$, PEF and MVV were lesser in higher experience group than the lower experience group[6].Further, Boskabady MH et al. found a significant reduction in FVC, FEV1, PEF, MMEF, $MEF_{75\%}$, and $MEF_{50\%}$ that could be secondary to restrictive lung disease, or carpentry work might have resulted in a combination of restrictive and obstructive lung diseases. However, their results also showed increased allergic symptoms among carpenters[15].

The decrease in pulmonary function might be due to the accumulation in peribronchial lymphoid and connective tissues associated with wall thickening and remodelling in terminal and respiratory bronchioles. Thickened bronchiolar walls contain carbon and mineral dust associated with increase in collagen and interstitial inflammatory cells including dust laden macrophages[16].

CONCLUSION

Thus, it can be concluded that high level of wood dust exposure in the wood mill industries may lead to pulmonary hazards. Maintenance of proper industrial hygiene and preventive measures can help in reducing the occupational health hazards.

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