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ASSESSMENT OF FORCED EXPIRATORY VOLUME IN WOOD DUST EXPOSURE

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ABSTRACT

INTRODUCTION : Wood dust is a by-product of wood processing and its components have a property of sensitizing and irritating the mucous membrane.

AIMS AND OBJECTIVES: To study forced expiratory volume in 1 second (FEV_1) in carpenters exposed to wood dust and to compare the values with healthy normal people.

MATERIAL AND METHODS: The present study was conducted in guwahati city on 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 in the age group of 20-40 years. FEV_1 values were calculated using Medspiror.

RESULTS: The mean FEV_1 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 exposure to wood dust deteriorates pulmonary functions.

KEYWORDS : Wood dust, FEV_1, carpenters

INTRODUCTION

Occupational diseases are a major concern, and several studies have been done to identify occupations which are at high risk of inducing disease[1].Wood dust is one of the most common occupational exposures leading to health hazards, with millions of workers exposed worldwide.Wood is harvested for its traditional use for fuel and construction material, and it is found to cause respiratory problems among exposed workers globally [2].

Wood dust is produced as a by-product of wood processing during cutting or shaping of wood materials and its components have a property of sensitizing and irritating the mucous membrane[3]. Besides,wood contains many microorganisms (including fungi),toxins and chemical substances which may significantly affect human health, leading to irritation of oral cavity and throat, tightness of the chest, irritant dermatitis, urticaria, alveolitis, deterioration of pulmonary functions, and a reduction of FEV_1(Forced expiratory volume in 1 second) [4].

Several studies have shown respiratory dysfunction in carpenters, including the reduction of pulmonary function tests in these workers[5]. Basic tools for evaluating the effect of wood dust exposure on respiratory system include pulmonary function tests[6,7] . Measurement of dynamic lung functions is more relevant than that of static lung volumes [8].

Several workers are engaged in woodworking industry in Guwahati but only a few studies have been done on this locality on the carpenters and on the associated health hazards.So the present study was undertaken to study the effects of wood dust exposure on the respiratory health of carpenters by studying its effects on forced expiratory volume in 1 sec (FEV_1) and compare the value with healthy normal people.

MATERIAL AND METHODS

The present study is a cross-sectional (comparative) study which was conducted in guwahati city. Ethical clearance was taken from institutional ethics committee before starting the study. Only male workers were selected for the study.The in-charge of carpentry workshop was informed before conducting the tests. Only co-operative subjects were taken who were explained in brief why the study was done. Detailed history and clinical examination of every subject was taken. In a 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.

200 non-smoker males were taken into study of which 100 were carpenters exposed to wood dust and 100 were healthy normal individuals never exposed to wood dust.The age group was 20-40 years. Persons having history of smoking, any allergy, cardiac or respiratory illness were excluded from the study. Carpenters having minimum duration of service of more than 1 year with 8 hours of work per day were selected.

The study group was further divided into two subgroups comprising of 50 carpenters with 1-5 years of exposure and the second group of 50 carpenters with more than 5years of exposure. Duration of exposure of upto 10 years was taken for study.

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

Forced expiratory volume in 1 second (FEV_1) was measured using an expirograph, Medspiror (Recorders and medicare systems pvt. ltd) which is an electronic device for assessing lung function parameters. The subjects were explained about the whole procedure and a practical demonstration was done. The medspiror was switched on and all parameters like name, age, height, weight, sex were entered. Then they were asked to close their nostrils and take maximum inspiration. The subjects were then asked to fix his lips on the mouthpiece making 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 demonstrated beforehand, a print of the record was taken by pressing print key of the machine.The procedure was repeated three times and the best of the three 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 $p<0.05$.The data was reported as Mean ± Standard Deviation. All statistical analysis were performed using Graph Pad Instat.

RESULTS AND OBSERVATIONS

The study comprised of 100 carpenters as the subject group and 100 non-carpenters as the control group so that the total

number of sample is 200.

Table 1: Comparison of the parameter FEV_1 (litres) among the Subject and Control group

Group	Mean	SD	d.f.	t-value	Significance
Subject	2.39	0.49	198	7.311*	p<0.01
Control	2.83	0.34			

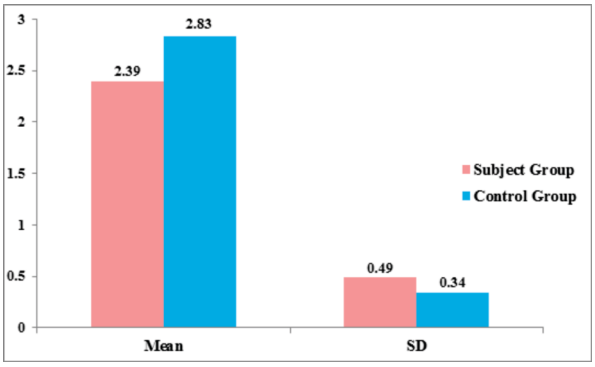

Figure 1: Graph showing the mean & SD-values of parameter FEV_1 (litres) between the subject and control groups.

Interpretation: Table 1 and figure 1 shows that the mean FEV_1 score was 2.83 with the SD value of 0.34 among the control group; while it was 2.39 with SD value of 0.49 among the subject group i.e the carpenters have lower mean score of FEV_1 than the non-carpenters. Student's unpaired 't'-test was applied and it has been found that the difference is statistically significant at 0.01 level as $p < 0.01$.

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

Table 2 : Mean distribution of FEV_1 among group A & group B & their 't'-values

Parameters	Group A (N=50)	Group B (N=50)	(d.f.)	t-value	Significance
	Mean± SD	Mean ± SD			
FEV_1(litres)	2.69±0.32	2.09±0.46	98	7.631*	p<0.01

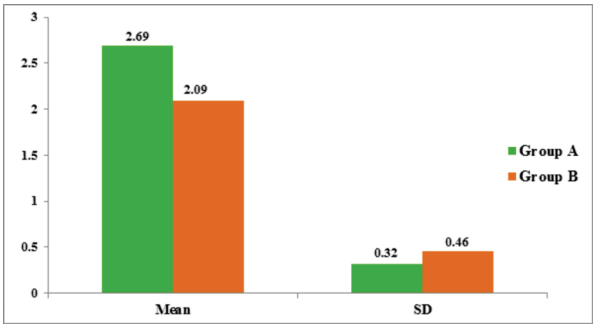

Figure 2: Graph showing the mean & SD values of FEV_1 (litres) among the subjects according to their duration of exposure

Interpretation: Table 2 and figure 2 have depicted the mean distribution of the parameter FEV_1 (litres) in group A and group B. Mean distribution in group A is 2.69 ± 0.32; while the same is 2.09 ± 0.46 in group B. So, FEV_1 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

The study was undertaken to see whether occupational exposure to wood dust leads to any ventilatory dysfunction and whether this effect has any relation with duration of exposure to wood dust. In the study, the effect of exposure to wood dust on forced expiratory volume in 1 second in the study group were compared with a control group as well as compared within the study group itself according to the grouping done as per their duration of exposure to wood dust.

Mean FEV_1 of subject group was found to be (2.39±0.49) litres and that of control group was found to be (2.83±0.34) litres. The difference between two groups was statistically significant ($p<0.01$). 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 value of FEV_1 in group A was (2.69 ± 0.32)litres and in group B was (2.09 ± 0.46)litres and their difference was statistically significant ($p<0.01$).So it can be seen that there is some degree of airway obstruction in the workers exposed to wood dust.The results are in unison with several studies done earlier on effect of wood dust exposure on pulmonary function.

In a study done by Ige OM, Onadeko OB (2000) it was found the mean PEFR of the saw millers (463.8 +/ 63.4 L/min) was significantly lower ($P < 0.0001$) than that of the control subjects (537.7 +/ 71.5 L/min).Similarly, the mean values of FEV_1, FVC and FEV_1% (FEV_1%) were also significantly lower in the FVC sawmillers than the control subjects [9].

Schlunssen V, Schaumburg I et al (2002),found that increased frequency of wheezing and a crossshift decrease in forced expiratory volume in 1 second among workers using pinewood was seen. In conclusion, wood dust exposure might cause respiratory symptoms, despite a relatively low exposure level .[10]

In another study by Schlunssen V, Sigsgaard T et al (2004), a positive exposure relationship between average dust exposure and cross-shift FEV_1 was shown for non-smokers only and appeared to be most pronounced among pine workers.[11]

Dudhmal V.B. et. al,(2006) did a study on sawmill factory workers which showed stastically significant decreased value of FEV_1 and PEFR in saw mill workers[12].

Erdinc osman and kayihan Pala (2009) conducted a study on wood workers in Turkey that showed that the mean FEV_1 and FVC values of woodworkers were significantly low as compared to control group[13].

While discussing the pathophysiological aspect of a reduction in the value of the aforesaid lung function parameter, the FEV_1 value is low in obstructive lung diseases and in reduced lung volume[14].

We have found that the decline in FEV_1 is a convenient standard against which we can measure marked declines in subjects with the history of chronic obstructive pulmonary disease (COPD) or in subject exposed to environmental pollutants[15].

Vedal et al. showed that the FVC and FEV_1 are decreased with a concentration of dust >2 mg/m3[16].

In the work done by Mbengue et al, negative correlations were found between seniority at the workplace and a few variables such as FEV_1,Tiffeneau's index, and MEF 25–75%[17].

Wood dust is a very composite substance and its constituents depend on the kind of wood that causes the dust and the treatments received (fungi, bacteria, preservatives, varnishes, waxes, paints, and glue). Carpentry work produce easily

inhalable fine particles that play an important role in the genesis of respiratory disorders, especially during sanding operations[18].

CONCLUSION

From the present study it can be concluded that chronic exposure to wood dust deteriorates pulmonary functions of carpenters.Wood dust causes chronic bronchial irritation which leads to restrictive plus obstructive type of pulmonary impairment of lung functions.So, periodic respiratory examination, health education and certain preventive measures must be adopted to ensure better health outcome for better work performance.

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