

Effects of Wood Dust on Cardiopulmonary Functions and Anthropometric Parameters of Carpenters and Non-Carpenters in Sabon Gari Local Government Area, Kaduna State, Nigeria

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Abstract: The aim of the study is to assess the blood pressure, pulse rate, peak expiratory flow rate, Forced Expiratory Volume in 1 sec (FEV₁), and Forced Vital Capacity (FVC) of carpenters and non-carpenters in Sabon-Gari local government area, Zaria. Their Body Mass Index (BMI) and other anthropometric data were also obtained. 200 males between the ages of 18 and 35 were used for this research. 100 were carpenters and 100 were non carpenters. As regard to the pulse rate there was no significant change in the carpenters when compared with the non-carpenters. In relation to the systolic, diastolic and mean arterial blood pressure, there was a significant increase ($p < 0.05$) in the carpenters when compared with the non-carpenters. Regarding the Forced Vital Capacity (FVC), Forced Expiratory Volume in 1 sec (FEV₁), (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. In conclusion, the effect of wood dust on carpenters increases the arterial blood pressure, decreases the forced vital capacity, forced expiratory volume in 1 sec and peak expiratory flow rate.

Key words: Anthropometric, blood pressure, peak exploratory flow rate

INTRODUCTION

Since the dawn of civilization, industries have been established to meet various human needs. Over the course of time, some of these industries were found to exert untoward effects on the health of man. Today, occupational lung diseases form an important of respiratory medicine. As knowledge increases so also is the awareness about the quality of life enjoyed by the workers. This has led to the determination of the health status of these workers (Kuschener and Stark, 2003).

Wood workers in well established industries in developed countries have an increased risk for asthma and other respiratory diseases (Demers *et al.*, 1997). Similar observations have been made in a recent study in Africa (Rongo *et al.*, 2002). In Nigeria, various studies have shown the role of occupational exposure to environmental pollutants in the incidence of respiratory diseases (Jinadu and Malomo, 1986; Alakija *et al.*, 1990; Ige and Onadeko, 2000; Okojie *et al.*, 2003; Ijadunola *et al.*, 2004; Okwari *et al.*, 2005). Cough and sputum production and breathlessness are some of the reported respiratory symptoms of these workers, while occupational asthma

(Rastogi *et al.*, 1989) and hypersensitivity pneumonitis (Brooks *et al.*, 1981) are recognized clinical syndromes common in such workers. The overall effect of these is a lower level of lung function in these workers.

In 2004, American Heart Association (AHA) published its first scientific statement regarding air pollution and cardiovascular disease (Brook *et al.*, 2004). There was an explicit aim to educate clinicians about the importance of this issue, because the cardiovascular health consequences of air pollution generally equal or exceed those due to pulmonary diseases (Brook, 2008). 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 PM level over the long term can reduce life expectancy by a few years. There is mounting evidence from a rapid growth of published data related to the harmful cardiovascular events of air pollution (Simkhovich *et al.*, 2008; Pope *et al.*, 2006). Most but not all epidemiological studies corroborate the elevated risk for cardiovascular

events associated with fine PM_{2.5}. PM_{2.5} generally has been associated with increased risks of myocardial infarction, stroke arrhythmia, and heart failure exacerbation within hours to days of exposure in susceptible individuals.

The manufacturing of wood involves processes and operations mainly related to the mechanization, which increases the probability of occurrence of occupational events (accidents at work and/ or occupational diseases). If we consider in addition the hazardous chemicals for finishes, the risk of illness and death of the worker greatly increases and his/her quality of life is reduced (OSHA, 1989). These processes involve hygiene risks such as those related to noise levels higher than 85 dBA, particulate matter, spraying of organic solvents and paints, among others. .

The aim of this experiment purpose of this experiment check the effect of wood dust among carpenters and non carpenters in Sabongari local Government of Kaduna state.

MATERIALS AND METHODS

The following materials were used for the research, Digital Vitalograph (Model S-48917), Wright peak flow meter (Cat.No. 29.000), Digital blood pressure monitor (Omron MX2 (HEM-742-E2) S/N 20081205060LF), Bathroom weight scale, Cotton wool, Dettol, Water, Vitalograph paper, Mouth pieces of the vitalograph.

Data collection technique: The experimental practical was carried out at a carpenter workshop in Sabon Gari area of Zaria, Kaduna State. A random sampling was done among the carpenters between the ages of 18 to 35, and who must have worked for at least 5-10 years. This was facilitated by the use of a questionnaire. This experiment involves a total of 200 subjects, 100 for carpenters (experimental group) and 100 non carpenters (control group).

At the commencement of the practical, the procedures of the experiments were practically demonstrated to the subjects, and the experimental parameters that were measured include vitalograph, peak flow rate, blood pressure, height and weight.

Vitalograph experiment: A mouth piece was inserted on the pipe of the vitalograph machine, and the subjects inspired maximally, and then maximally expire into the mouth piece and the breath held until the vitalograph pencil gets to the end of the vitalograph paper. FVC and FEV1 were calculated from the result.

Peak Expiratory Flow Rate (PEFR): A Wright peak flow meter was used to measure the peak expiratory flow rate. The mouth piece of the apparatus was disinfected

Table 1: Showing the Mean±SEM of the anthropometric parameters of the control and experimental groups

Parameters	Control group	Experimental group
Age (years)	23.90±0.36	24.60±0.61 ^{ns}
Height (m ²)	1.72±0.01	1.72±0.01 ^{ns}
Weight (Kg)	60.37±0.72	61.45±1.10 ^{ns}
BMI (Kg/m ²)	20.53±10.02	20.77±10.03 ^{ns}

^{ns}: not significant; ^a: significant

Table 2: Showing the Mean±SEM of the Systolic b.p., Diastolic b.p., Mean Arterial b.p., and pulse rate of control and experimental groups

Parameters	Control group	Experimental group
Systolic blood pressure (mmHg)	124.87±1.34	135.76±1.73 ^a
Diastolic blood pressure (mmHg)	72.76±1.03	78.28±1.16 ^a
Mean arterial blood pressure (mmHg)	89.92±1.05	97.42±1.11 ^a
Pulse rate (beat/min)	77.46±1.51	76.75±1.37 ^a

^a: Statistically significant

with Dettol constantly before each subject uses it. The subjects expire forcefully with speed into it and the vane of the apparatus indicates the level reached. The apparatus is calibrated in L/min.

Blood pressure: A digital blood pressure monitor was used. The arm band of the monitor was tied around the left arm of the subject just above the median cubital fossa. The monitor measured the systolic blood pressure, diastolic blood pressure and pulse rate.

Height: The height was measured by the use of a metre rule. The subjects were asked to stand without shoes and caps against a wall that is calibrated in metres and their heights were taken.

Weight: The weight was measured with a bathroom scale weight. The subjects stood on the scale without phones or any encumbrances that could alter their appropriate weight, and their weight was taken.

Statistical analysis: The sampling technique used was simple random sampling. Results were expressed as mean±SEM and statistical comparison of measured variables between the 2 groups were carried out using independent-t-test and difference among means were calculated at a level of p<0.05.

RESULTS

Table 1 shows comparisons between the anthropometric parameters of the experimental groups, that is the carpenters and the control groups, the non-carpenters there was no significant deference in all the anthropometric parameters tested between the experimental groups, when compared to the control non-carpenters groups (p>0.05).

Table 3: Showing the Mean±SEM of the PEFR, FEV1%, FEV1, and FVC of the Control and experimental groups

Parameters	Control group	Experimental group
PEFR (L/min)	400.31±7.40	342.72±8.30 ^a
FEV1%	79.24±1.75	67.29±2.18 ^a
FEV1	2.29±0.08	1.59±0.09 ^a
FVC	2.88±0.08	2.33±0.09 ^a

^a: Statistically significant

Table 2 shows comparisons between the cardiovascular parameters of the experimental groups, that is the carpenters and the control groups, the non-carpenters there was a significant increase in the experimental group in all the tested cardiovascular parameters when compared to the control non-carpenters groups ($p < 0.05$).

Table 3 shows comparisons between the function parameters of the experimental groups, that is the carpenters and the control groups, the non-carpenters there was a significant decrease in the experimental group in all the tested parameters when compared to the control non-carpenters groups ($p < 0.05$).

DISCUSSION

There was a significant ($p < 0.05$) increase in systolic blood pressure among the carpenters compared to the control. This is in agreement with the work of Gong *et al.* (2003), who observed that there is an increase in the systolic blood pressure in healthy subjects on exposure to PM_{2.5}. There was a significant ($p < 0.05$) increase in the diastolic blood pressure among carpenters compared to the control. This is related to the result obtained by Urch *et al.* (2005), who observed a significant increase of about 6mmHg in subjects exposed to particulate matter. There was a significant ($p < 0.05$) increase in the mean arterial blood pressure among carpenters when compared to the control. This is consistent with the work of Chuang *et al.* (2005), Liu *et al.* (2007), Auchincloss *et al.* (2008), all of whom observed increase in systemic arterial blood pressure of approximately 10 $\mu\text{g}/\text{m}^3$ elevation in PM.

There was no significant change in the pulse rate of the carpenters ($p > 0.05$) when compared to the control. Studies demonstrated that acute PM exposure is capable of reducing Heart Rate Variability (HRV). More consistent reductions have been found among older adults and perhaps with exposure to large particles (Devlin *et al.*, 2003; Gong *et al.*, 2004). The general pattern suggests that PM exposure is associated with increased heart rate and reductions in most indices of HRV among older susceptible individuals, such as those with obesity and the metabolic syndrome.

The result shows a significant ($p < 0.05$) decrease in PEFR, FEV1, and FVC. This is consistent with the work of Ige and Onadeko (2000). 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 Ahuja (1983), 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 Iyawe and Ebomiya (2005). Who observed that sawdust exposure ultimately results in airway remodeling 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.

CONCLUSION

The systolic blood pressure, diastolic blood pressure, and mean arterial blood pressure is significantly increased among the carpenters. There is no significant change in pulse rate of the carpenters when compared with non-carpenters, although previous studies have not consistently documented such changes.

The Peak Expiratory Flow Rate (PEFR), Forced Vital Capacity (FVC), 1 sec Forced Expiratory Volume (FEV1), and the FEV1/FVC ratio (FEV1%) are significantly reduced among carpenters.

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