International Journal of Biomedical and Health Sciences
Vol. 3, No. 1, March 31, 2007
Printed in Nigeria

0794-4748/2007 $12.00 + 0.00

http://www.asopah.org

IJBHS 2007005/3107

Peak expiratory flow rate in automobile spray painters living in Benin City, Nigeria

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(Received February 9, 2007)

ABSTRACT: Fifty (50) subjects who are spray painters or spray painting apprentices were used for this experiment. The subjects used have all been exposed to fumes of paint for periods which varied between two (2) to twenty-eight (28) years. All the subjects used were males since hardly any females in Benin City are in the profession. The respiratory assessments were done by the use of Peak flow meter. Respiratory rates of subjects were also measured. Fifty (50) subjects who are not exposed to paint fumes served as control.

During the preliminary studies, it was observed that the spray painters were quite aware of the negative effects of spray paint fumes on their respiratory tract. All the spray painters used protective devices like the use of nose masks, use of foam or piece of cloth to cover nose. We then went ahead to access the peak flow in L/ min in the spray painters and their apprentices.

Results show that there was a significant reduction ($p< 0.05$) in the mean peak flow rate of the spray painters (438L/minute) when compared with mean peak flow rate of non-spray painters (468.57L/minute), despite the protective devices used by the spray painters. Thus the spray fumes affects the peak expiratory flow rate.

Key Words: Respiratory assessment; Respiratory rates; Peak flow meter; Expiratory flow rate.

Introduction

Chronic exposure to fine particulate materials constitutes a respiratory health hazard as airway resistance is increased and compliance of the lung is affected. Several workers have studied the effect of cigarette smokes on the lung function[8.] Working with vapors, gases, dust, or fumes was significantly associated with chronic bronchitis and airway obstruction[2,4].

Paint is a mixture of a pigment and a mobile vehicle which together form a liquid that can be applied to a surface, providing an adherent coating that imparts color and often protects the surface coated. One of the ways of applying paint to the surfaces is by spraying the mixture. The resulting aerosol is coated onto the exposed surface. The emissions at spray painting and surface coating premises, present a threat to workers, neighbors and environment.

The main objectives of this study are as follows:

(a) To determine the effects of paint fumes on the peak expiratory flow rate.

(b) To establish the effect of paint fumes on respiratory airflow in professional spray painters.

(c) To recommend appropriate measures to alleviate the respiratory side effects of such substances and thus prevent them.

Workplace related asthma is a growing problem accounting for up to 15% of all cases of asthma. More than 200 occupationally related agents have been implicated, and the list continues to expand [1]. In a particularly interesting study [2], a twenty three (23) year-old spray painter developed contact dermatitis and respiratory difficulty characterized by small airways obstruction shortly after a polyfunctional aziridine cross-linker CX-100 began to be used in his workplace as a paint activator. The symptoms resolved after he was removed from the workplace and was treated with inhaled and topical steroids. Painters may have an increased risk of asthma due to exposure to a variety of agents, such as isocyanates, alkyd resins, and chromates. This case illustrates the importance of using appropriate work practice and personal protective equipment to minimize exposure.

Exposure to cement dust has been found to have effect on the airway with symptoms of chronic respiratory disease and reduction in ventilatory capacity [3,4].

It has also been observed that chronic bronchitis and mild airway obstruction was associated with bakers and spray painters[5]. Studies done by Reyes de la Rocha S and his team [6] showed obstructive ventilatory pattern in 90% spray painters who were exposed to spray fumes.

Peak expiratory flow rate is the maximum amount of air expired maximally in one (1) minute after a maximum forced inspiration. It is very important for analyzing any obstructive disease.

Materials and methods

Cluster samples of 50 male spray painters were selected randomly from amongst professional spray painters in different locations within the city of Benin. The criteria for selection included exposure to paint fumes for upward of 2 years with no previous evidence of cardio-respiratory illness. The Peak Expiratory flow rate was carried out using a mobile Flow meter (Wright's peak flow meter). The tests were carried out after informed consent was obtained from the subjects between the hours of 8 am to about 1 pm daily. The subjects falling approximately in the age range of 15-50 years were subjected to series of tests which includes systolic and diastolic blood pressures, resting heart rate, respiratory rate, peak flow rates as well as their demographic parameters like age, body weight, height and chest circumference.

The resting heart rates, respiratory rates, systolic and diastolic blood pressures were measured while patient sat down quietly without distraction.

A control group of 50 males who are not exposed to the paint spray fumes were also employed for this study. The control groups were randomly selected amongst fellow auto-workmen like auto-electricians, mechanics etc, who are of approximately the same socioeconomic status working in a similar environment without exposure to spray paint fumes.

Results and Discussion

Table 1 shows comparative data for spray painters and non-spray painters. There was a statistically significant decrease in the peak flow readings of the spray painters (438.70L/Minute) when compared with those of non- spray painters (468.57L/Minute) ($p < 0.05$). There was a slight increase in the blood pressure of spray painters. This was not statistically significant, however.

Responses from our subjects reveal about 100% awareness by spray painters of possible respiratory health hazards of spray paint fumes. They were conscious of possible respiratory hazard The spray painters were aware of the possible side effects of the spray fumes. We had earlier on thought they were unawares of the health hazards associated with spray painting considering their level of education and socioeconomic status. The high level of awareness among the spray painters could explain the reason behind the cooperation enjoyed from the spray painters during the fieldwork. Also, with this level of awareness the spray painters can easily comply with recommendations got from the result of this research work.

Table 1: Comparison of the some physiological parameters in Spray Painters and Non Spray Painters.

Physiological Parameters	Spray Painters	Non-Spray Painters (Control)
Peak Flow Rate (L/min)	438.70 ± 51.06	463.57 ± 51.11
Systolic Blood Pressure (mmHg)	130.74 ± 13.98	127.31 ± 14.64
Diastolic Blood Pressure (mmHg)	74.84 ± 14.17	68.53 ± 12.88
Heart Rate (Beats/min)	79.20 ± 15.38	75.94 ± 15.27
Respiratory Rate (Resp/min)	21.36 ± 2.98	21.43 ± 3.11
Weight (Kg)	63.16 ± 8.89	64.94 ± 8.23
Height (Ft)	5.67 ± 2.22	5.76 ± 0.27
Chest Circumference (in)	34.44 ± 0.05	34.57 ± 2.52

The results reveal a statistically significant difference in the peak flow rates between spray painters and the control non- spray- painters($p > 0.05$) This difference despite the use of local protective devices like the use of nose masks, application of foams or cloth to cover nose etc, shows that spray paints increase airway resistance. This is in line with work done by Fishwick *et al*. [5] where he and his group observed that chronic bronchitis and mild airway obstruction was associated with bakers and spray painters.

Reyes de la Rocha *et al* [6] had previously reported obstructive ventillatory patterns in 90% subjects who were intentionally subjected to spray paints. Chattopadhyay *et al*[9] also did a similar study on pulmonary function abnormalities associated with exposure to automobile exaust in diesel bus garage.

Also, the Journal of environ Health Perspects [2] published a case of a 23 year old spray painter characterized by small airway obstruction shortly after the polyfunctional aziridine cross linker CX 100 began to be used in his workplace as a paint activator. This is a clear example of occupational related respiratory hazard. This is particularly important in asthmatic patients whose asthmatic attacks can be triggered by spray paint fumes. Work related asthma refers to pre existing asthma that is worsened by irritants and or physical stimuli in workplace [1].

In a similar vein, Iyawe *et al* [7] looked into the time course and bronchiodilator effect of caffeine in young Nigerians.

The sample size had to be curtailed because of the peculiarity of this profession where it is very difficult getting the subjects. Statistical analysis of subjects to relate the years of exposure to the degree of airway obstruction could not be accurately extrapolated due to the number of samples present in each exposure grouping. Results, however, from broader classification of 2 to 20 years exposure and from 20 years and above shows a decrease in mean peak flow with those exposed for over 20 years. The protective measures are thus not effective enough.

Conclusion

From the results, the spray fumes increase airway resistance as there is a statistical reduction in peak expiratory ($p < 0.05$)flow rate in the spray painters. Also the local protective measures by the professional spray painters in Benin are not effective enough to prevent the health hazard associated with spray painting.

Recommendations

Spray booths should be fitted with filters to catch over spray and these filters should be maintained according to supplier's instructions. Spray paintings must be done in a spray booth that can control the emissions of particles and solvents. Apart from the effects on the airway resistance, spraying in the open

can lead to soil contamination, vegetation damage and fallout on to other sensitive surfaces such as cars. Spray painting must, therefore, be done in spray booth that can control the spray fumes.

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