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RESEARCH ARTICLE

MEASUREMENT OF PEAK FLOW RATE IN BUS DEPOT WORKERS

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ABSTRACT

Pune City is the rapidly expanding city. Buses are one of the modes public transports. Bus drivers and conductors are constantly exposed to air pollution. Its effect on respiratory system can be assessed by Peak Expiratory Flow Rate (PEFR). Material and methods: Study group consisted of 30 bus drivers and conductors working for more than 10 years. Control group consisted 30 age and BMI matched subjects. PEFR was measured using mini Wright's peak flow meter and compared in both the groups. Results: PEFR values of the bus depot workers were significantly low than that control group. Conclusion: Peak flow rate was found significantly reduced in bus depot workers who were exposed to air pollution daily for many years.

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INTRODUCTION

Pune City is one of the rapidly expanding cities in Maharashtra. Here roads are an extremely important mode of transport. There has been a tremendous increase in the traffic volume on the roads comprising of private vehicles and public transport vehicles. They bring with them the inevitable hazards of increased vehicular exhaust and subsequent air pollution to which travelers, bus drivers and conductors are constantly exposed. Duty hours during heavy traffic period lead to more exposure to air pollutants and increase in cardiorespiratory, gastrointestinal and musculoskeletal disorders in these workers, ultimately causing poor health outcome (HEI, 2003). Most of the hazards are due to vehicular air pollution to which bus transport workers are constantly exposed. According to study conducted by Central Pollution Control Board (CPCB) 2010, India; air quality is deteriorating in metro cities like Pune and the transport sector is contributing more than 70% of the ambient air pollution (CPCB, 2010). Health impacts of air pollution are serious. Some deadly toxins, harmful gases and carcinogens are present in vehicular emissions. Levels of nitrogen oxide (NO), sulphur dioxide (SO2) and suspended particulate matter (SPM) concentrations are exceeding standard levels due to tremendous increase in number of vehicles (Milind *et al*., 2012). Several studies found an increased risk of respiratory symptoms or disease in people who are exposure to vehicle exhausts (Sagar *et al*., 2007; Purushottam *et al*., 2013)

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N. Bagheri Lankarani, *et al* studied lung function in 356 female and 206 male students for six-weeks and they concluded that outdoor air pollutants are directly correlated with poor lung function in the children (Narges Bagheri Lankarani *et al*., 2010). A five-year survey of Swiss customs officers investigated the adverse effects of diesel-engine emissions on respiratory mucous membranes and it was shown that there was chronic inflammatory response due to chronic exposure (Ulrich Glück *et al.,* 2003). Transport workers who are exposed to air pollution more than 8 hours per day for many years are maximally prone to various respiratory diseases.

Peak Expiratory Flow Rate (PEFR) is the amount of air a person can exhale during a forced expiration after taking a full breath. It is one of the accurate, sensitive and practicable index to detect airway obstruction. It assesses ventilatory lung function (Mridha *et al.,* 2011) and is a practicable test to measure lung function both in the community and clinical settings. PEFR is measured with peak flow meter which is a simple portable instrument. Therefore this study was planned to screen the transport workers who are exposed to air pollution for respiratory disorders by measuring PEFR.

MATERIALS AND METHODS

This was a cross sectional observational study. Subjects were bus drivers and conductors working for more than 10 years in the bus depot, Katraj Pune.30 subjects in the age group of 30 years and above were randomly selected. The control group

consisted of 30 age and BMI matched males who were not exposed to air pollution in their daily routine. Smokers and subjects suffering from respiratory disorders were excluded from the study. A careful history was taken and detail clinical examination was done. Anthropometric parameters including standing height was measured to the nearest centimeter without shoes and body weight was recorded in kilograms for each subject. Body mass index was calculated as weight (kg)/height (m^2) (World Health Organization 1998)

PEFR was measured by using mini Wright's peak flow meter. Subject was asked to take deep inspiration then to affix his lips tightly over the nozzle of the peak flow meter to prevent any air leak and to exhale out forcefully as fast as possible in the peak flow meter with nose closed (Parminder Kaur *et al*., 2012). All the readings were taken in standing position. Care was taken that the initial reading was always at the zero mark. Peak Expiratory Flow Rate was recorded in liters/minute. Three readings were taken and best of the three reading was recorded. PEFR was measured in control and study group and readings were compared.

RESULTS

Table 1. Comparison of mean values of the age and BMI of the study group and the control group

Parameter	Study group	Control group	P value
Age in years (Mean ± SD)	40±29	39.89±67	>0.01*
BMI Kg/m^2 (Mean ± SD)	22.66±3.25	22.65±3.36	>0.01*

*not significant

Table 1 shows that study group and control group are comparable with respect to age and BMI

Table 2. Comparison of PEFR in the study group and the control group

parameter	Study Group	Control Group	*p value*
PEFR lit/min. (Mean ± SD)	341.7±63.68	421±67.84	0.0001#

Highly significant

Table 2 shows that PEFR values of the bus depot workers were significantly low than that control group.

DISCUSSION

In this study respiratory effects of air pollution were assessed by measuring PEFR. Peak expiratory flow may show variation according to height, weight and obesity status in the same age group. But in our study there was no significant difference in physical parameters like BMI and WHR. Both the groups were comparable. As per the results it is obvious that bus depot workers were having significantly low PEFR indicative of trachiobronchial obstruction. This could be due to exposure of these workers to air pollution during their duty period which was more than 8 hours a day for many years. Air pollution is mainly caused by vehicular exhaust which contains carbon monoxide, nitrogen oxide, sulfur dioxide and tar derivatives. These chemicals cause bronco-constriction either directly or indirectly. Prolonged exposure may lead to chronic bronchitis, repeated attacks of bronchial asthma and COPD (Fleming *et al*., 2001).

Prior studies have shown that these inhaled substances have strong pulmonary and systemic inflammatory potentials and can cause irritation and allergic response in the lungs and air passage of individuals who are exposed to them for a long time (Ekpenyong *et al*., 2012). However, the type of disease developed, depends on the size of the particles, chemical inhaled and the local response of the lung tissue. In some cases, larger particles tend to end up trapped in the nose or larger air ways. Small particles in the order of 10µm or less can penetrate the deepest part of the lungs such as bronchioles or alveoli (Kampa *et al*., 2008). Sometimes they get absorbed in various organs and have more serious biological effects (Bakke *et al*., 1991). However in our study; expansion of lung, diffusion function and systemic hazards were not studied.

Mustafa Mahfuz and coworkers conducted pulmonary function tests in transport workers of one of the most polluted city, Dhaka. They concluded that 41.7% had obstructive and 4.6% had combined features of pulmonary impairment (Mahfuz *et al*., 2014). Sharat Gupta *et al* evaluated extent of impairment in lung function in traffic policemen in and around Patiala city (Gupta *et al*., 2011). There was a significant decline in various parameters like FVC, FEV1, PEFR and it was correlated with pollution by vehicular exhaust. Another study also points out that, lung functions of petrol station workers declined significantly with increasing years of work in petrol stations, in both smokers and non-smokers (Mayank Singhal *et al*., 2007). All these evidences prove that air pollution is one of the culprits for adverse health effects. Bus depot workers are the most vulnerable for respiratory diseases due to air pollution so regular medical checkup for respiratory functions should be mandatory. Personal protective devices can be recommended to these workers. Regular servicing of vehicles and changes in the shifts of the workers should also be promoted. Implementations of more stringent emission control measures are also essential.

Conclusion

Peak flow rate was found significantly reduced in bus depot workers who were exposed to air pollution daily for many years.

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