International Journal of Medical Research & Health Sciences

www.ijmrhs.com Volume 2 Issue 1 Jan-Mar 2013 Coden: IJMRHS Copyright @2013 ISSN:2319-5886

Received: 15th Nov 2012 Revised: 13th Dec 2012 Accepted: 19th Dec 2012

Original research article

A COMPARATIVE STUDY AMONG THE THREE WHEELER AUTOMOBILE DRIVERS ON PULMONARY FUNCTION TESTS IN ADULT MALES OF GULBARGA CITY

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ABSTRACT

Background: Development of our country has led to rapid urbanization and there is increasing use of automobiles that is aggravating environmental pollution. Occupational exposure to automobile exhaust and industrial smokes has been shown to affect functioning of different systems of the body. The present study was taken up to assess the Pulmonary Function Tests (PFT) in auto rickshaw drivers of Gulbarga city. **Methods**: Fifty non –smoker male auto drivers in the age group of 20–50 years for more than 5 years of auto driving experience formed the study group. Age and sex matched individuals not exposed to auto rickshaw driving [administrative staff] formed the control group. Pulmonary function parameters FVC, FEV1, FEV1%, PEFR, PIFR, $FEF_{25-75,}$ FEF_{50} and MVV were assessed using a computerized Spiro meter during their working hours and were statistically analyzed. **Results**: There was a highly significant decrease in FVC and FEV_1 in the study group compared to control group. The decrease in FEV1%, PIFR, FEF_{25-75} and FEF_{50} were statistically significant but the decrease in PEFR and MVV were statistically non-significant. **Conclusion**: Our findings point towards the adverse effects of vehicle exhaust on lung functions, mainly on lower airways with restrictive pattern of disease.

Keywords: Automobiles, Auto drivers, Pulmonary function tests.

INTRODUCTION

The development of our country has brought many changes that include increased industrialization, improved transportation facilities, jobs in various fields. Modern lifestyles have certain adverse effects on our surroundings. Rapid urbanization led to increased use of automobiles that is aggravating environmental pollution. Experimental studies indicate that airborne contaminants lead to injury to the airways and lung parenchyma in subjects who are exposed to it [(1,2)]. Occupational exposure to automobile exhaust and industrial smokes has been shown to affect functioning of different systems of the body. Numerous epidemiological studies have documented decrements in pulmonary function and various other health

problems associated with long term air pollution exposure[3-7] .Health effects of occupational exposure to petroleum vapors and air pollution from vehicular sources is relatively unexplored among auto rickshaw drivers. There is limited published data regarding the pulmonary function test abnormalities in auto-rickshaw drivers. Hence we undertook this study.

To meet the present day requirement, there is an increase automobile use and because of the predominant role of gasoline [petrol] as a motor vehicle fuel, the effects of gasoline engine emissions are potentially even greater problems. In the persons exposed to these pollutants, pulmonary function tests are used as screening tests to determine their effects[8] .Therefore, the present study is taken up to evaluate the changes in Pulmonary Function Tests (PFTs) like Forced Vital Capacity (FVC), Forced Expiratory Volume in the first second (FEV1), FEV1/FVC ratio, Peak Expiratory Flow Rate (PEFR), Peak Inspiratory Flow Rate (PIFR), Forced Expiratory Flow in 25-75% of vital capacity(FEF_{25-75}), Forced Expiratory Flow at 50% of vital capacity (FEF_{50}) and Maximum Voluntary Ventilation (MVV) of auto rickshaw drivers in Gulbarga city.

MATERIALS AND METHODS

The present study was conducted in Salgar hospital in Gulbarga city. Gulbarga is located in the north Karnataka region of South India. Ethical clearance was taken from the Institutional Ethical Committee and each subject gave the consent.

The study group consisted of 50 males in the age group of 20–50 year, who was driving auto rickshaw for 8 hours per day for more than 5 years in Gulbarga city. The control group consisted of 50 males of the same age group from administrative post, who were not exposed to auto rickshaw driving. The subjects in the study group and the control group had certain inclusion and exclusion criteria.

Inclusion criteria

Male subjects of age between 20-50 years and subjects with no history of allergic disorders, respiratory disorders like asthma, or any systemic disease, no history of smoking, chewing tobacco and intake of alcohol.

Exclusion criteria

Subjects with age less than 20 years and more than 50 years of age, alcoholics, persons with systemic diseases, smokers who had chest wall deformities, neuromuscular disease, severe obesity, previous thoracic surgery and females were excluded from the study.

Age, height, and weight were recorded. All the Pulmonary functions were tested during day time using computerized Spirometer [MEDSPIROR]. The subjects were familiarized with the instrument. All the tests were carried out at the same time of the day, between 10-11 AM. All the subjects were in sitting position and wearing nose clips[9]. The subjects were asked to breathe forcefully following deep inspiration into the mouthpiece attached to the pneumatachometer. 3 readings of maximal Inspiratory and expiratory efforts were recorded and the best reading was taken for statistical analysis. Statistical methods used in our study was a student's unpaired t test using SPSS-16. The $P< 0.05$ was considered statistically significant and $P< 0.001$ was considered highly statistically significant.

RESULTS

Table:1. Comparison of mean values of the age, height and weight of the subjects and the controls

Parameters	Study group	Control group
Age [years]	36.4±7.40	34.8±3.76
Height [cm]	170.40 ± 3.39	174.60 ± 4.15
Weight [kg]	72.60 ± 7.56	74.40 ± 8.24

The subjects and controls did not differ significantly on above parameters.

Table: 2. Comparison of lung volumes and capacities between study and control groups

Parameter	Study group (n=50)	Control group (n=50)	p-value
FVC (L)	2.77±0.41	3.33±0.50	0.001**
FEV1 (L)	2.67±0.46	3.11±0.33	0.001**
FEV1%	88.25±13.34	90.31±10.12	0.050*
MVV (L/min)	110.80±18.63	130.16±26.89	0.059

*P value<0.05 is statistically Significant, **P value<0.001 is highly statistically Significant

In table-2 there was highly statistically significant decrease in FVC, and FEV1 in the study group when compared to the control group. There was a statistically significant decrease in FEV_1. In addition, there was a decrease in MVV but it was not statistically significant.

Table: 3. Comparison of flow rates among study and control groups

Parameter	Study group (n=50) Mean ±SD	Control group (n=50) Mean ±SD	P value
PEFR (L/min)	5.47±1.40	7.05±1.59	0.15
PIFR (L/min)	2.21±0.67	3.61±1.10	0.04*
FEF_{25-75} (L/min)	3.60±1.33	4.85±1.11	0.04*
FEF_{50} (L/min)	4.16±1.22	5.17±1.32	0.05*

*P value<0.05 is statistically Significant, **P value<0.001 is highly statistically Significant

Table 3 indicates the flow rates among both the groups. The decrease in PEFR was statistically not significant whereas the decrease in PIFR, FEF_{25-75} and FEF_{50} was statistically significant with $p \leq 0.05$.

DISCUSSION

Occupational health has been gaining importance for the fact that long term exposure to vehicle exhaust, petrol and dust can lead to a permanent morbidity. The acute health risks involved are minimal, provided that the precautionary methods are used in accordance with appropriate health and safety practices.

Highly statistically significant decrease in FVC and FEV1 was observed in auto drivers when compared to their controls, and their ratio (FEV1%) was significant between the two groups. This finding indicates the restrictive pattern of pulmonary involvement in the study group. Auto rickshaw drivers are at risk of dust inhalation, petrol vapor inhalation and also inhalation of automobile exhaust for a longer period of time that is at least 8 hours per day for more than one year and they have more chances of chronic involvement of lungs as indicated by the results in the present study.

The benzene content of petrol has typically been in the range 1–5% may be an exacerbating factor for the lung function abnormalities observed as the study groups were nonsmokers. Smoking as an independent variable was found to affect FEV1 significantly and smoking has shown to accelerate the decline in lung function in a time dependent manner[10]. As the auto drivers are most of the time on busy roads and exposed to automobile exhaust and other air pollutants. Automobile exhaust is a complex mixture of different gases like Sulphur dioxide (SO_2), Carbon dioxide, Carbon monoxide (CO), Nitrogen dioxide (NO_2) and particulate matter. Some studies have demonstrated that exposure to particulate matter combined with exposure to an

irritant gas such as NO_2 results in greater damage to the lung than when exposed to either substance individually[11].In combination with particulate pollutants, SO_2 and NO_2 have a greater chance to reach the deeper parts of the lungs. The gaseous pollutants may also alter the properties and concentration of surfactant and contribute to the early closure of small airways. Much of the terminal bronchioles may be compromised before other pulmonary function tests such as FEV1 are affected[12].

Few histopathological studies have provided evidence that the small airways are the site of damage in people living in areas of high air pollution[13]. The particles generated from diesel exhaust are extremely small and are present in the nuclei or accumulation modes with a diameter of 0.02 ηm and 0.2 ηm respectively. These small sized particles, by virtue of their greater surface area to mass ratio, can carry a much larger fraction of toxic compounds, such as hydrocarbons and metals on their surface. Importantly they can remain airborne for long periods of time and get deposited in greater numbers and deeper into the lungs than larger sized particles. Hence chronic exposure to them can lead to chronic inflammation of respiratory tract and lung parenchyma. These would contribute to the substantial decrease in lung functions in the form of a restrictive pattern as indicated in the present study.

Rajkumar studied the effect of air pollution on the respiratory system of the auto rickshaw drivers in Delhi. The study found that (19%) drivers showed normal Pulmonary Function Test (PFT). (80%) showed mild and moderate to severe obstruction, of which (48%) were non-smokers and (52%) were smokers and the result concludes that auto rickshaw drivers have a high respiratory morbidity due to exposure to pollution.[14] In a study, reduced mechanical properties of breathing were attributed to exposure to benzene in the vapors of petrol[15].

Bijendra Kumar et al examined the pulmonary function test in three wheeler diesel taxi drivers in Bikaner city. They found restrictive impairment in 87% of the study group, of which 50% were smokers and 37% were non-smokers, mixed pattern (both restrictive and early obstructive impairment) was found in only 13% of the study group, of which 7% were smokers and 5% non-smoker. So they concluded that when all the five parameters (FVC, FEV1, FEV1/FVC, FEF 25–75% and PEFR) were taken together they were indicative of mixed pattern (obstructive and restrictive) lung impairments [16].

Chattopadhyay et al conducted a study on garage workers, drivers and conductors of Kolkata city to assess the pulmonary function status of these workers and found that FEV1, FEV1% and flow rates, FEF 02-121, FEF25%-75% values showed a gradual decrement as age and duration of exposure increased[17].

CONCLUSION

From the present study it was concluded that respiratory functions of the auto rickshaw drivers who are continuously exposed to emissions from vehicles, petrol vapor and dust were significantly reduced as compared to respiratory functions of age, weight and height matched control groups.

To prevent the respiratory dysfunction among auto drivers, medical observation and periodic checkups for pulmonary function tests should be performed. Control strategies should be adopted to reduce the vapor concentration in the air, like vapor adsorbents and to reduce the benzene concentration in the ambient air. Personal protective equipment must be worn by auto rickshaw drivers. Imparting health education to auto rickshaw drivers will prevent respiratory morbidity. Further long term perspective studies on auto rickshaw drivers will help in getting a comprehensive picture of long term effects.

ACKNOWLEDGEMENT

This research paper is made possible by the support from the participants of our study. We dedicate our acknowledgment of gratitude towards Mr.Shaik.Meera and Dr. Rashmi.C.G as

they kindly read our paper and offered valuable detailed advices on grammar, organization, and theme of the paper. Finally, we sincerely thank almighty, family and friends, who provided financial support and timely advice.

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