



Evaluation of Pulmonary Functions in Traffic Police Personnel: A Cross-Sectional Study from Latur, Maharashtra

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ABSTRACT:

Background: Air pollution due to automobile exhaust on road is the major concern of health hazards in urban population. Traffic police working on busy street suffer more due to air pollution than general population.

objectives: The aim and objective of this study was to evaluate the pulmonary function in traffic police personnel working at the road traffic junctions and compare it with control working in office environment.

Material and Methods: This comparative cross-sectional study was carried out in 30 traffic police personnel and 30 normal healthy individuals as a control. Evaluation of pulmonary function tests were conducted in designated PFT room with the help of Easyone™ DIAGNOSTIC 6.2 digital spirometer.

Results: There was significant decline found in VC, FVC and PEF while insignificant change in TV in Traffic police personnel as compare to control group.

Conclusion: this study concludes that traffic police personnel working at road traffic junction are more susceptible to air pollution than general population. Hence, they need awareness about the ill effects of air pollution and use of personal protective aids to minimize it.

Introduction

Automobile exhaust significantly contributes to add pollutant in atmosphere and cause different types of respiratory problems in people living in it. Exposed individuals develop Restrictive, obstructive and combined type's respiratory impairments. Among the exposed workers police managing traffic on road have a great extent of health hazards due to automobile exhaust as they spent ample of time on road than less exposed population. [1,2] Hazards pollutants in working environment attributed by automobile exhaust in the form of particulate matter, Nitrogen oxide, ozone and oxygen reactive species ends into inflammatory and oxidative stress. [3,4] City of Gujarat, [5] Pondicherry, [6, 7.]

Jaipur [8] have few studies regarding consequences of atmospheric pollutants on lung functions working on busy streets, but no similar data was in hand showing consequences polluted air by automobile exhaust on lung functions of traffic controlling police in city in this area. Hence similar study designed to know the status of the pulmonary functions in police working on busy streets in this area.

Materials and methods

Cross sectional comparative study was designed and approved by Institutional ethical committee. Study was carried out in 30 traffic police personnel as study subjects and thirty normal healthy individuals as a



control from the same city. The study group subjects (TPP) were between twenty-five to forty-five years (mean age: 35.03 ± 8.12 SD) of age and with minimum five years of exposure to air pollutant while managing traffic on road. Age (Mean age: 34.56 ± 7.47 SD) and sex matched healthy individual as control group were selected. Subjects were properly explained about the aim, objectives, study methodology and expected outcome and written informed consents were obtained from all the subjects. All the study participants were males and belong to the same population group. BMI calculated by obtaining height and weight in study and control group.

All the study participants were screened in the medicine outpatient department to exclude the structural deformities and functional disorder, infective lung diseases like tuberculosis that may affect the pulmonary functions. Subjects having any functional or anatomical disorders interfering Respiratory functions were not included in the study. Subjects having history of smoking, under the treatment for diabetes mellitus and hypertension also were included in the study. All the information collected in patient information sheet of the subjects and kept confidential.

Study participants were satisfactorily demonstrated regarding instruments and different PFT maneuvers by trained technicians. All the individuals (study and control group) were subjected to PFT's, in designated PFT unit of the institute and all PFTs were carried out by the trained technicians under observation of investigators. PFT parameters were measured by using non-invasive and quite accurate digital spirometer (Easyone TM DIAGNOSTIC 6.2).

All the subjects were asked to relax and made familiarize with laboratory environment. The lips were tightly closed around the mouthpiece and noses clipped

to prevent air leakage. They were instructed to inhale from and exhale into spirometer through disposable mouthpiece. The same maneuvers repeated thrice and the best reading out of three was taken. VC (Forced vital capacity), FEV1 % (forced expiratory volume at the end of 1 second as a percentage of FVC), PEF (peak expiratory flow) and TV (tidal volume) were recorded and entered in data sheet.

Statistical analysis and methods-

Data was collected by using a structure proforma. Data thus was entered in MS excel sheet and analysed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of percentages and proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Comparison of mean and SD between two groups will be done by using unpaired t test to assess whether the mean difference between groups is significant or not. Descriptive statistics of each variable was presented in terms of Mean, standard deviation, standard error of mean. A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

Results

The control and study group (traffic police personnel-TPP) were compared for the age, height, body weight and BMI using two tailed un-paired Student's t test which found insignificant difference between two groups for age in years (34.57 vs 35.03), height in centimeters (171.9 vs 172.63), weight in kg (71.6 vs 75.53) and BMI in kg/m^2 (24.24 vs 25.1) (Table I).

The TPP were exposed to automobile exhaust for a mean period of 9.25 ± 3.73 years while the controls were not exposed to automobile exhaust in their work environment and the study results of the pulmonary function tests in TPP are summarized in Table II.

Table I - Anthropometric details of Participants

	Control group(n=30)	Study group (n=30)	Significance (p Value)
Age (years)	34.57 ± 7.47	35.03 ± 8.13	> 0.05 #
Height (cm)	71.9 ± 5.55	72.63 ± 4.71	> 0.05 #
Weight (kg)	71.6 ± 8.66	75.53 ± 7.96	> 0.05 #
BMI (kg/m^2)	24.24 ± 2.88	25.1 ± 2.67	> 0.05 #

statistically non-significant

**Table II - Comparison of VC (L), FEV1 (%), PEF (L/s), and TV (ml) between control and study group.**

Parameter	Control group (n=30)	Study group (n=30)	Significance (p value)
VC (L)	3.81 ± 0.64	3.41 ± 0.51	< 0.05, Statistically significant
FEV1 (%)	83.05±3.75	79.34±6.26	< 0.01, Statistically significant
PEF (L/s)	8.06 ± 1.59	7.21 ± 1.30	< 0.05, Statistically significant
TV (ml)	487±73	515± 83	> 0.05 Statistically not significant

Discussion

Study data was analyzed to study the effects air pollutants on pulmonary functions in traffic police engaged in traffic duty on road. Various studies conducted in different parts of India as and also outside India to evaluate the effect of air pollution on the respiratory functions. But limited data was available to know the adverse effect of traffic related air borne pollutants on the pulmonary functions of traffic police in suburban rural area.

On one hand automobiles became a must need to living comfortable and convenient life but they have also made humans more vulnerable and complicated in terms of toxic emissions, production of noise and accident risk on road. People residing in urban area are more prone to effects of air pollutants but traffic police remain worst sufferers while working close to busy traffic points in city. Studies till date in India indicate that significant number of traffic police becomes victim to lung disorders, eye irritation and skin problems. Hence spirometry is the noninvasive and nearly accurate tool for assessment of the patient's respiratory status [9].

Mean values of all the recorded parameters in present study, VC (<0.05), FEV1 (<0.01), and PEF (<0.05) were declined significantly in TPP compared to control group except TV.

All the results are similar with those of Ingle S T et al,^[9] Deepankar et al,^[10] Sharat Gupta et al,^[11] Rastogi et al,^[12] Pravati Pal et al,^[13] Anuj Chawla et al,^[14] Evans R G et al,^[15] Bharat B Sharma et al ^[16] and Kumar K S et al. ^[17]

The observed decline in above mentioned PFT parameter could be caused by prolonged exposure to

vehicular pollution. Automobile exhaust is a complex mixture of different gases and particulate matter. These include gases that contains nitrogen and oxygen (NO, NO₂), carbon monoxide, Sulphur dioxide, hydrocarbons and particulate matter (PM). It has been observed in different animal studies that exposure to irritant gases and particulate matters combined together results in greater lung damage than when exposed to either substance individually. Particulate matter of 2.5m and 10m (PM₁₀, PM_{2.5}) size and NO₂ found significantly associated with reduced VC. Similar effects of automobile exhausts on the VC and FEV1 have been reported in tunnel and bridge workers, traffic wardens and shopkeepers. Prolonged inflammatory changes in airway by vehicular emission causes excess mucus production and airway obstruction. The particulate matters, gases like CO₂, CO, NO₂, NO and toxic chemicals sulfur, lead, benzene may play role in pathogenesis of respiratory disease and produce irritation, allergy and hypersensitive airways of individuals who exposed to them for long time.^[10,11,13,14] High ambient air concentrations of pollutants had clearly defined and significant systemic pulmonary inflammatory response with reduced forced vital capacity (FVC), forced expiratory volume at the end of first second (FEV1), inspiratory-expiratory flow rates. [3, 4, 20]

In present study the mean observed value of TV was little higher in study groups than control (487±73 ml vs 515±83 ml) but not reach to significant level (p > 0.05). This could be due to reduction in physiological functioning of the lungs in study group. The tidal volume (TV) is nothing but air taken in or taken out during quite breathing and this fulfils the oxygen demands during rest. This reduction in normal



functioning of lungs due to increased anatomical and physiological dead space normal inhaled volume may not be adequate to supply the oxygen demand of the body at rest or resulting into decreased diffusion of gases. ^[13]

The results of this study contradict with Nakai et al [18] and Valpino P et al [19]. A cross-sectional study conducted by Nakai et al in Hodogaya, Japan, between different levels of vehicular exhaust exposure followed by repeated PFTs for 4 years, suggested that road traffic pollutants linked with respiratory problems in exposed individuals and did not reveal any consistent differences on repeated pulmonary function tests.

Volpino P et al ^[19] evaluated the effects of urban pollutants on respiratory and cardiovascular functions in exposed traffic policemen of Rome. They observed insignificant differences in the mean values of resting ventilatory capacity, the forced spirometric test.

Conclusion

This study concluded that long time exposures to air pollutants by working near heavy road traffic junctions are harmful for the respiratory health. In view of above observations to preserve the respiratory health and related hazards air pollution can be controlled by using high efficiency less polluting fuels, stoppage of usage of lead, increased the usage of non-conventional energy resources, promoting the use of e-vehicles and using preventive measure like face masks like personnel protective aids by traffic policemen and worker working near busy traffic junctions.

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References

1. B P Chattopadhyay, J Alam, A Roychowdhury. Pulmonary function abnormalities associated with exposure to

- automobile exhaust in a diesel bus garage and roads. *Lung*. 2003; 181(5):291-302
2. S Sasikumar, K Maheshkumar, K Dilara, R Padmavathi. Assessment of pulmonary functions among traffic police personnel in Chennai city - A comparative cross-sectional study. *J Family Med Prim Care*. 2020 Jul 30; 9(7):3356-3360.
3. Maura Lodovici, Elisabetta Bigagli. Oxidative stress and air pollution exposure. *J Toxicol*. 2011; 2011:487074.
4. Xiaoquan Rao, Jixin Zhong, Robert D Brook, Sanjay Rajagopalan. Effect of Particulate Matter Air Pollution on Cardiovascular Oxidative Stress Pathways. *Review, Antioxid Redox Signal*. 2018 Mar 20; 28(9):797-818.
5. Makwana AH, Solanki JD, Gokhale PA, Mehta HB, Shah CJ, Gadhavi BP. Study of computerized spirometric parameters of traffic police personnel of Saurashtra region, Gujarat, India *Lung India*. 2015;32:457-61
6. Ranganadin P, Chinnakali P, Vasudevan K, Rajaram M. Respiratory health status of traffic policemen in Puducherry, South India *Int J Curr Res Rev*. 2013;5:87
7. Dutta T, Pal G. Pulmonary function test in traffic police personnel in Pondicherry *Indian J Physiol Pharmacol*. 2010;54:329-36
8. Singh V, Sharma BB, Yadav R, Meena P. Respiratory morbidity attributed to auto-exhaust pollution in traffic policemen of Jaipur, India *J Asthma*. 2009;46:118-21
9. Ingle S T, Bhushan G. Pachpande, Nilesh D. Wagh, Vijaybhai S. Patel, Sanjay B. Attarde. Exposure to Vehicular Pollution and Respiratory Impairment of Traffic Policemen in Jalgaon City, India. *Industrial Health* 2005, 43, 656-662.
10. Deepankar, Sharma Shivani. A case control study to find effect of air pollution over lung function tests in traffic policemen. *Journal of Advance Researches in Biological Sciences*, 2011, 3 (1a) 20-23.
11. Sharat Gupta, Shallu Mittal, Avnish Kumar, Kamal D Singh. Respiratory effects of air pollutants among non-smoking traffic



- policemen of Patiala, India. *Lung India*, Oct-Dec 2011. Vol 48, Issue 4; 253-257.
12. S K Rastogi, B N Gupta, Tanveer Husain and Seema Srivastava. Pulmonary function evaluation in traffic policemen exposed to automobile exhaust. *Ind Journal of Occup health*, 1991;34: 67-71.
 13. Pravati Pal, John Robert A, T. K. Dutta, G. K. Pal. Pulmonary function test in traffic police personnel in Pondicherry. *Indian J Physiol Pharmacol*.2010; 54 (4): 329-336.
 14. Anuj Chawla, A. K. Lavania. Air pollution and fuel vapour induced changes in lung functions: are fuel handlers safe? *Indian J Physiol Pharmacol* 2008; 52 (3): 255-261.
 15. Evans RG, Webb K, Homan S, Ayres SM. Cross sectional and longitudinal changes in pulmonary function with automobile pollution among bridge and tunnel officers. *Am J Ind Med* 1988; 14:25-36.
 16. Bharat Bhushan Sharma, Virendra Singh, Rajeev Yadav, Pradeep Meena. Respiratory Morbidity Attributed to Auto-exhaust Pollution in Traffic Policemen of Jaipur, India.; *Journal of Asthma*. 2009, Vol. 46, No. 2, Pages 118-121.
 17. Kumar K S, Prasad C E, Balakrishna N, Rao K V, Reddy P U. Respiratory symptoms and spirometric observations in relation to atmospheric pollutants in a sample of urban population. *Asia Pac J Public Health* 2000; 12: 58-64.
 18. Nakai S, Nitta H, Maeda K. Respiratory health associated with exposure to automobile exhaust III. Results of a cross-sectional study, and repeated pulmonary function tests from 1987 to 1990. *Arch Environ Health* 1999; 54:26-33.
 19. Volpino P, Tomie F, La Valle c. Respiratory and cardiovascular function at rest and during exercise testing in a healthy working population: effects of outdoor traffic air pollution. *Occup Med* 2004; 45: 475-482.
 20. Nazia Uzma, B. M. Khaja Mohinuddin Salar, B. Santhosh Kumar, Nusrat Aziz, M. Anthony David, V. Devender Reddy. Impact of Organic Solvents and Environmental Pollutants on the Physiological Function in Petrol Filling Workers. *Int. J. Environ. Res. Public Health* 2008, 5(3) 139-146.