

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Evaluation Of Pulmonary Function Test (PFT) Parameters In Male Traffic Police In A Metropolitan City Pune, Maharashtra, India.

Santosh Rohidas Bokre¹, Anil Raosaheb Waghmare^{2*},
Karuna Bajrang Gaisamudre³, and Sangita Deshpande⁴.

¹Assistant Professor, Department of Physiology, SKNMC&GH, Pune, Maharashtra, India.

²Associate Professor, Department of Physiology, B.J. Govt. Medical College, Pune, Maharashtra, India.

³Associate Professor, Department of Physiology, Govt. Medical College, Chhatrapati Sambhajnagar, Maharashtra, India.

⁴Associate Professor, Department of Physiology, Govt. Medical College, Miraj, Maharashtra, India.

ABSTRACT

Air pollution is a major environmental health problem. The air quality problem in Indian cities is mainly caused by vehicular emissions, which contain various particulates and gases from vehicular emissions. Traffic police professionals who work together for years at busy traffic lights are constantly exposed to this hazardous substance and are therefore prone to its adverse effects such as respiratory diseases and cardiovascular diseases. This study was conducted in the Department of Physiology between government Medical College as nurses, pharmacists and other technical staff not exposed to traffic pollution and traffic police officers exposed to vehicular pollution. PFT was performed in both these groups and parameters such as tidal volume (TV), expiratory reserve volume (ERV), inspiratory reserve volume (IRV), maximal ventilatory volume (MVV) were measured and compared between the two groups. In this study, traffic police officers (non-smokers) showed statistically significant reductions in TV, ERV, IRV and MVV compared to controls (non-smokers), while traffic police officers (smokers) showed statistically significant reductions in TV, ERV, IRV and MVV compared to Controls (smokers). The significant reduction of all parameters in traffic police officers compared to the control group proves that preventive measures such as anti-pollution masks, regular breathing exercises, etc. must be implemented in the workplace to reduce the health risk of permanent exposure to traffic dust and air pollutants.

Keywords: Traffic police, Health risks, Non-smoker, Smoker, Spirometry.

<https://doi.org/10.33887/rjpbcs/2024.15.1.57>

**Corresponding author*

INTRODUCTION

Air pollution is a major environmental health threat. The air quality crisis in Indian cities is mainly caused by vehicular emissions, which contain various particulates and gases from vehicular emissions. The link between air pollution and health arose in the 20th century with the occurrence of large air pollution episodes, followed by an increase in mortality and morbidity. According to a European assessment, air pollution accounts for 6% of all deaths and 50% of these deaths are caused by air pollution from vehicular pollution [1].

Chronic exposure is associated with coughing, sputum production and decreased lung function capacity. In the long term, pollutants can induce diseases such as asthma and bronchitis in exposed individuals. Inhalation of pollutants causes bronchoconstriction, mucosal irritation and alveolar swelling leading to obstructive, restrictive or combined lung disorders. The prevalence of obstructive, restrictive and mixed types of functional lung damage has been found to have a direct relationship with dust concentration and duration of exposure[2].

Traffic police officers are continuously exposed to car emissions, dust and other pollutants without any preventive measures, which make them susceptible and account for impaired lung function over time [3].

Since occupation is a major determinant of health, traffic police officers face numerous occupational hazards. They work in a noisy and polluted environment. Standing for long periods in a static position makes them prone to ergonomic problems. They cope with high traffic density which results in physical and mental fatigue which makes them prone to physical and mental stress. Manifestations of physical and mental health become more pronounced as the length of service increases. Poor interpersonal relationships, lack of adequate personal time, 10–12-hour daily shifts that disrupt normal sleep and social life are a few other stressors faced by members of the police force.

Therefore, a study was conducted to compare various pulmonary function test (PFT) parameters in traffic police officers to determine the effect of smoking on these lung functions.

METHODS

PFT was performed in both of these groups. The parameters used in these two groups for comparison on PFT were:

TV – tidal volume
ERV-Expiratory reserve volume
IRV-inspiratory reserve volume
MVV-Maximum Ventilation Volume

All individuals between the ages of 20 and 50 years were selected and divided into two groups of 130 subjects each, which are further divided into 2 subgroups as Smokers and Nonsmokers as follows.

Group 1

- 130 male police officers engaged in traffic control in the age group from 20 to 50 years old from local stations with exposure to dust at least 5-7 hours/day.
- They were selected from local transport stations.
- They did not use any personal protective measures to avoid dust exposure

Group 2 (control)

Apparently healthy men in the age group of 20 to 50 serving in the government Medical College as nurses, pharmacists and other technical staff but not exposed to traffic pollution were considered as controls.

Traffic police officers were individually matched for age, height and weight with controls. The control subjects were from a similar socio-economic group, evaluated by questionnaire.

Sample size

- In group 1, 130 subjects were taken.
- In group 2, 130 subjects were taken.

Inclusion criteria

Apparently healthy men in the age group of 20 to 50 serving in the Government Medical College as nurses, pharmacists and other technical staff but are not exposed to traffic pollution.

130 male police officers engaged in traffic control in the age group from 20 to 50 years old from local stations with exposure to dust at least 5-7 hours/day.

Exclusion criteria

Known case of Hypertension, Ischemic heart disease, Myocardial infarction, Diabetes mellitus, Alcoholic liver disease, Ascites and Hepatosplenomegaly.

Trauma to chest and thorax surgery in the past.

Congenital \ Acquired chest or spine deformity like Kyphosis, Scoliosis, Pigeon chest etc

Subjects having H/o acute or chronic respiratory infections, smoking, current or previous drug reactions, cardiopulmonary, neuromuscular disease, malignancy, diabetes mellitus, major abdominal or chest surgery.

The study was conducted in Department of Physiology, IEC approval was taken .

The procedure was explained and detailed informed consent was obtained.

Two consecutive sputum samples were tested before performing pulmonary function tests to rule out tuberculosis. PFT were recorded using "HELIOS 702 (RMS, INDIA) SPIROMETER MACHINE." All tests were carried out at fixed time of the day to minimize the diurnal variations. The apparatus was calibrated daily and it was operated within ambient temperature range. The precise technique of executing various lung function tests were based on operational manual of instrument and the recommendations which were made by the American thoracic society for a standard technique of spirometry [4].

The data record was reproduced as PFT report. Parameters like age, height, weight were noted.

Age: The present age of the subject in complete years were noted down.

Height: Bare foot standing height is recorded in centimeter.

Weight: Was recorded in kilograms.

Procedure carried out in sitting position. Pneumotach was fitted tightly in the mouth with teeth & lips to avoid leakage of air. Nose clip was used to prevent leakage of air from nose. The test procedure was explained to the subject nicely.

The Parameters used in these two groups for comparison on PFT were

- TV – Tidal volume
- ERV-Expiratory reserve volume
- IRV-Inspiratory reserve volume
- MVV-Maximum ventilatory volume

OBSERVATION AND RESULTS:

Table 1: The demographic data of the two study groups

Parameter	Control (Mean ± SD)		Traffic Police (Mean ± SD)	
	Non-Smoker	Smoker	Non-Smoker	Smoker
Age (Yrs)	34.4 ± 5.10	33.66 ± 5.28	31.89 ± 5.48	32.46 ± 5.35
Weight (Kg)	58.91 ± 9.10	59.33 ± 8.31	53.68 ± 12.81	51.76 ± 11.23
Height(m)	1.62 ± 0.06	1.63 ± 0.06	1.58 ± 0.072	1.57 ± 0.08

SD: Standard deviation

Table 2: Mean TV, ERV, IRV, Mean MVV in two study groups

Parameter	Control (Mean ± SD)		Traffic Police (Mean ± SD)		P value	
	Non-Smoker	Smoker	Non-Smoker	Smoker	Non-Smoker	Smoker
TV	4.94 ± 0.32	4.16 ± 0.15	4.94 ± 0.32	4.16 ± 0.15	1.0000	1.0000
ERV	3.12 ± 0.15	2.28 ± 0.25	1.047 ± 0.18	2.28 ± 0.25	<0.0001	1.0000
IRV	1.04 ± 0.18	0.86 ± 0.19	3.127 ± 0.15	0.86 ± 0.19	<0.0001	1.0000
MVV(L/min)	112.59 ± 23.19	107.71 ± 20.36	89.88 ± 33.99	87.9 ± 26.5	<0.0001	0.0019

In present study, mean levels of Tidal Volume (TV) in Non-Smoker traffic policemen group (4.94±0.32) were found similar to Non-Smoker Control group (4.94±0.32). Mean levels of Tidal Volume (TV) in Smoker traffic policemen group (4.16±0.15) were also found similar to Smoker Control group (4.16±0.15). Mean levels of Inspiratory Reserve Volume (IRV) in Non-Smoker traffic policemen group (3.127± 0.15) were higher than Non-Smoker Control group (1.04 ± 0.18). This difference was statistically significant (p<0.0001) when compared by using unpaired t test. Mean levels of Inspiratory Reserve Volume (IRV) in Smoker traffic policemen group (0.86±0.19) were found similar to Smoker Control group (0.86±0.19). Mean levels of Expiratory Reserve Volume (ERV) in Non-Smoker traffic policemen group (1.047± 0.18) were lower than Non-Smoker Control group (3.12 ± 0.15). This difference was statistically significant (p<0.0001) when compared by using unpaired t test. Mean levels of Expiratory Reserve Volume (ERV) in Smoker traffic policemen group (2.28±0.25) were found similar to Smoker Control group (2.28±0.25).

In present study, mean levels of Maximum Voluntary Ventilation (MVV) in Non-Smoker traffic policemen group (89.88 ± 33.99) were lower than Non-Smoker Control group (112.59 ± 23.19). This difference was statistically significant (p<0.0001) when compared by using unpaired t test. Mean levels of Maximum Voluntary Ventilation (MVV) in Smoker traffic policemen group (87.9±26.5) was also found lower than Smoker Control group (107.71 ± 20.36) and difference was statistically significant (p=0.0019) when compared by using unpaired t test.

DISCUSSION

In our study, Traffic police personnel had significantly declined Tidal volume (TV), Expiratory reserve volume (ERV), Inspiratory reserve volume (IRV), and maximum voluntary ventilation (MVV) when compared with predictive normal values, which is probably due to exposure to vehicular exhaust. Comparison of test values between groups showed significantly reduced TV, ERV, IRV and MVV in cases as compared to controls. Traffic personnel with longer duration of exposure showed significantly reduced lung functions than those with shorter duration. Smokers showed lower test values as compared to non-smokers with significance only in unexposed group.

Exposure to air pollutants is known to be harmful to health and in particular to the lungs. Traffic police personnel, due to the nature of their job are at a particular risk as they are continuously exposed to emissions from vehicles [5]. Prolonged exposure to dust can cause bronchial problems. Acute effects include irritation of the eyes and nose, lung function changes, headache, fatigue and nausea. Chronic exposure is associated with cough, sputum production and reduction in lung function. In the long run, the pollutants produce diseases like asthma, COPD and malignancy in the exposed individuals apart from significant changes in lung functions. Pulmonary function tests parameters showed a reduction in

respiratory function of traffic policemen. The significant differences were observed between observed and expected values.

This fact is strengthened by high prevalence of obstructive disease in this population. Similar observations have been observed in studies in India and other countries as well. The increase in prevalence of respiratory symptoms among other occupation like taxi drivers, auto-rickshaw drivers have been reported in some studies. Reduction in PEFV values indicate the risk of obstructive airway disease in this occupational group who are exposed to air pollutants every day [6,7].

This decline in lung function parameters may be due to a large number of pollutants such as sulfur dioxide, carbon monoxide, nitric oxide, particulate matter and ozone influence on the body. These pollutants put a burden on the lungs and the resulting oxidative stress is thought to contribute to the genesis of fibrotic lung diseases, chronic bronchitis, emphysema, and lung cancer. Toxic chemicals and gases of vehicular emission produce irritation and allergy in the lungs and airways of subjects who are exposed to them for a long time, like the subjects of our study, traffic policemen.

The fact that majority of the policemen did not use any protective mask increases this risk. Though 60% of the traffic policemen were exposed for less than three years duration, the high level of obstructive respiratory disease in traffic policemen might indicate higher density of air pollutants. Assessment of respiratory status by spirometry along with clinical history and examination would have added strength to the study. Detailed information on air pollutants of the study area would have helped to understand the issue better. These are some limitations of the study. Pre-placement examination like in other industries would help the individuals to choose right job and reduce the risk of getting ill. Periodic examination of traffic policemen will help in identifying the health problems. Emphasis has to put on preventive aspects rather than on diagnosis and management of respiratory diseases. Hence protective mask wearing and reduction timing of work shifts will help in reducing the exposure to air pollution [8-10].

CONCLUSION

Significant reduction in all the parameters in Traffic policemen compared to Control group proves that preventive measures like pollution masks, Regular breathing exercises etc. have to be implemented at the workplace to reduce health hazards of continuous exposure to traffic dust.

REFERENCES

- [1] Kunzli N, Kaiser R, Medina S, Studnicka M, Chanel O, Filliger P. Public-health impact of outdoor and traffic-related air pollution: A European assessment. *Lancet* 2000; 356: 795-801.
- [2] Pravati Pal et al. Pulmonary function test in traffic police personnel in Pondicherry *Indian J Physiol Pharmacol* 2010; 54(4): 329-336.
- [3] Prashant Patil, Girish Thakare, Sarika Patil. Comparative Study of Lung Function Test of Policemen in Traffic Control with those in General Duty *National Journal of Physiology, Pharmacy & Pharmacology* 2013;3(2):162 - 166.
- [4] Pajanivel Ranganadin, Palanivel Chinnakali , Kavita Vasudevan, Manju Rajaram. Respiratory Health Status Of Traffic Policemen In Puducherry, South India. *Int J Cur Res Rev* 2013;05(07): 88-92.
- [5] Vijay Raina, Sunil Sachdev, Rajiv Kumar Gupta. Study of Pulmonary Function Tests of Traffic Policemen In Jammu Region. *JK Science* 2014;16(3).
- [6] Rajan R. Patil, Satish Kumar Chetlapally, And Mapilliraju Bagavandas. Global review of studies on traffic police with special focus on environmental health effects. *International Journal Of Occupational Medicine And Environmental Health* 2014;27(4):523 - 535
- [7] Hari Sunder Shrestha, Ojashwi Nepal, Kishor Khanal, Bhoopinder Kumar Kapoor. A cross-sectional study of lung functions in traffic police personnel at work in Kathmandu Valley, Nepal. *ACCLM* 2015;1(1):42-48.
- [8] Salvi Sheetal R, Prasad Neelam B, Bhandari Nikhil J. An Occupational Contingency in Traffic Police Personnel and Factory Workers In and Around Pune City. *International Journal of Health Sciences & Research.* 2014;5(8):266.



- [9] Saritha Jayachandran Shenoy, Sumadevi Vengasseril Sarasamma. A study of pulmonary function tests in traffic policemen in Kottayam district and normal healthy adults. *J Evid Based Med Health* 2017;4(8).
- [10] Vinay Singh, Devesh Kumar, Farhat Ali, Gaurav Kumar. Effect of traffic air pollution on spirometric parameters in Eastern Uttar Pradesh population. *India Int J Res Med Sci* 2016;4(10):4326-4328.