



# Effect of Pulmonary Function Tests on Traffic Policemen of Visakhapatnam,India

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| A.Anuradha        | Women Scientist (WOS B),Department of Human Genetics,Andhra University     |
| V.Lakshmi Kalpana | Asst Professor,Department of Human Genetics,AndhraUniversity,Visakhapatnam |
| S.Narsinga Rao    | Asst Professor ,Andhra Medical College,Visakhapatnam                       |

ABSTRACT

The present study was carried out to assess the lung functions of traffic policemen in Visakhapatnam city. A cross sectional study was carried out among 52 traffic policemen and compared with 47 general duty policemen. Pulmonary Function Tests (PFTs) like FVC, FEV1 ,FEV1/FVC ratio,PEFR performed on computerized spirometry. The results revealed that all lung functions were lower than the healthy controls and differences were statistically marked in FVC,FEV1 and PEFR. Intergroup comparison between traffic and general duty policemen revealed that policemen in general duty had better lung function than traffic showing values which are statistically significant ( FVC -0.0098, FEV1- 0.0096 and PEFR-0.0001). The findings from these studies are easily generalizable and can help us understanding the impact of air pollution on the traffic policemen

KEYWORDS : Traffic Policemen , Spirometry , PFTs

**Introduction:**  
Air pollution has been considered as the major cause for various adverse health outcomes.The pollutants in the air are responsible for acute effects causing respiratory symptoms, cardiovascular events, hospital admissions and mortality,Several studies have shown that ventilatory lung values are related to age, sex, anthropometric parameters, ethnic origin, smoking habit, occupational exposure, environmental conditions and methods used (Ward et al.,2004;Sin et al., 2005;Hyatt, 1983;Weimann et al., 1995).

Studies on air pollution use spirometric measures obtained from forced expiration maneuvers. Forced Vital Capacity (FVC) calculates the total volume exhaled after a maximum inspiration. Forced Expiratory Volume within 1 second (FEV1) is a marker of airway obstruction, measuring the maximum volume that can be exhaled within 1 second. Other commonly used measures are Peak Expiratory Flow (PEF) and Forced Expiratory Flow between the 25th and 75th percentile of FVC (FEF25–75), also known as Maximum Mid Expiratory Flow (MMEF).

Several studies have reported deterioration in the lung function tests among the road side workers, vendors, petrol pump workers especially traffic policemen. However most of these studies available world wide and few studies are from South India. The present study is aimed to assess the pulmonary functional status in traffic policemen of Visakhapatnam, Andhra Pradesh, India who have exposed to long term vehicular pollution and to compare these findings with general duty policemen.

**Material and Methods:**  
The present study was carried out among 52 traffic policemen and 47 age and sex matched general duty policemen who were working in and around Visakhapatnam city. Each subject was provided a questionnaire to get information about their age ,height, weight ,health status and consent to participate in the study.

**Selection of the subject:**  
**Inclusion Criteria:**

- Policemen willing to participate in the research study.
- Policemen employed in and around Gajuwakha, Visakhapatnam.
- Traffic policemen in the age group of 21-57years.
- Select traffic policemen randomly who are occupationally exposed to vehicular exhaust for varying durations of time(2-28years).

**Exclusion Criteria:**  
Traffic policemen who has >2yrs of exposure to pollutants.

**Pulmonary Function Test (PFT)** is carried out on traffic and general duty policemen by using computerized spirometer (SPIROWIN). Age ,height and weight of the policemen were entered in spirometer before taking the data.The subjects were asked to inspire slowly as much air as possible and then expire all of the air as fast as possible. Nose must be well fitted to preclude the

possibility of losing expired air into the atmosphere. Similar tests were performed thrice and subjects were trained to improve the efforts.The highest value data set will be considered for further analysis.The parameters include Forced Vital Capacity(FVC), Forced Expiratory Volume in 1 sec(FEV1),FEV1/FVC ratio ,Peak Expiratory Flow (PEF). The procedures followed were in accordance with the ethical standards of the institutional committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

**Statistical Analysis:**  
The data obtained was analysed for Mean and Standard Deviation (SD) and statistical difference was calculated with Graph Pad by using unpaired students ‘t’ test.

**Results:**  
**Table 1** demonstrates the comparison of mean values of age, height and weight of traffic and general duty policemen which shows mean values of age in years, height in cms and weight in kgs.

Table 1 : Demographical Profile of Policemen

| Demographic Parameters | Traffic Policemen (Mean ±SD) | General duty policemen (Mean ±SD) |
|------------------------|------------------------------|-----------------------------------|
| Age(years)             | 37.980 ± 10.126              | 36.782 ± 9.982                    |
| Height(cms)            | 172.902± 4.172553            | 170.2391± 7.183886                |
| Weight(kgs)            | 75.352± 10.673               | 70.47826± 12.35357                |

**Table 2** explains the comparison of mean values of Pulmonary function parameters(FVC,FEV1, FEV1/FVC ratio and PEFR )in traffic and general duty policemen.

**Table 2 : Comparison of Respiratory Parameters**

| Observed pulmonary Function Parameters | Traffic Police-men (Mean $\pm$ SD) | General duty Policemen (Mean $\pm$ SD) | P- Value |
|--|------------------------------------|--|----------|
| FVC                                    | 3.385 $\pm$ 0.488                  | 3.081 $\pm$ 0.655                      | 0.0098*  |
| FEV1                                   | 3.019412 $\pm$ 0.46615             | 2.735 $\pm$ 0.588                      | 0.0096*  |
| FEV1/FVC ratio                         | 89.139 $\pm$ 5.379                 | 88.834 $\pm$ 6.987                     | 0.8077   |
| PEFR                                   | 8.012 $\pm$ 1.717                  | 6.484 $\pm$ 1.751                      | 0.0001*  |

P < 0.05 is considered to be statistically significant

From the above table , it is evident that the Pulmonary Function Parameters FVC,FEV1 and PEFR were found to be highly significant whereas FEV1/FVC ratio was statistically insignificant.

### Discussion:

There is enough epidemiological evidence to show that vehicular pollution can cause increased morbidity and mortality. Some health effects may result from short-term exposure, while others are related to long-term exposure. Traffic police have been the natural choice as the subjects for studying adverse health effects from vehicular pollution due to their occupation requiring them to be in the middle of heavy traffic. Although a number of different health effects have been reported, the majority of the studies devoted to traffic police have largely focused on three specific outcomes, namely respiratory morbidity, cytogenetic effect and carcinogenic effect(Sydbom et al.,2001;Gotschi et al.,2008).

The effect of vehicular pollution on the respiratory health has been the primary research question for the majority of the studies looking into health effects of vehicular air pollution. The evidence accumulated in this respect has come from methodologically diverse studies. Most of them have reported a decrease in the lung function and increased respiratory morbidity. Yet, there are many studies that have failed to show any association between vehicular pollution and a decreased lung function. Vehicular traffic contributes a major portion of the air pollution and study results on traffic police can be extrapolated to a larger population, provided that the confounding variables are adjusted for (Kelly 2011;Balakrishnan 2011).

PFTs are non- invasive diagnostic tests that provide measurable feedback about the function of lungs. An assessment of lung volumes, capacities and flow rates provide specific information for clinical diagnosis and research purposes. Study of PFTs in workers in different occupations define safe conditions and in assessing the effects of exposure to known hazards. There has been an exponential increase in automobiles in the last couple of decades with resulting in increase in air pollution levels in and around Visakhapatnam city.

The present study designed to test respiratory health of traffic policemen who constitute a high risk group in terms of health and occupation, as they are exposed to diesel exhaust, organic and inorganic substances present in petrol, particulate matter, photoionizable dust. The various lung function parameters recorded were compared between traffic and general duty policemen.

Globally,about 1.3 billion urban residents are exposed to air pollution level above recommended limits. Since 2 decades, air quality in the developed countries has improved, air quality has deteriorated in many developing countries like India due to rising industrial activity and congestion of streets with poorly maintained motor vehicles that use leaded fuel (World development report,1993;Maxcy – Rosenau,1993).

There are several studies to found the role of diesel particle in pulmonary function, organic diesel exhaust particle chemicals also induce apoptosis and necrosis in bronchial epithelial cells via a mitochondrial pathway(Dickson et al.,2008;Nel et al.,2001). Diesel Exhaust Particles (DEP) may consists of a carbon core surrounded by trace metals, such as nickel, and salts to which are adsorbed organic hydrocarbons. Many of these components have inflammatory effects in the lungs of laboratory animals. For example, intratracheal instillation of ultrafine

carbon particles in rats leads to neutrophil flux into the lungs and increase in Broncho Alveolar Lavage Fluid (BALF) concentrations of Tumour NecrosisFactor- (TNF) - alpha. Intratracheal instillation of nickel in rats causes severe and sustained inflammation,with generation of free radicals. Hydrocarbons inhalation also leads to lung inflammation.The above observations indicate that diesel particles(Inoue et al.,2006; Nightingale et al.,2000) themselves can induce airway inflammation .This may be the reason for decreased FVC and FEVand PEFR in traffic policemen.

Our study revealed that FVC had been significantly reduced in the traffic policemen suggesting restrictive pattern of lung disease. FEV1 and PEFR were also significantly reduced in traffic policemen suggesting obstructive lung disease. Thus our findings suggest reduced lung function in traffic policemen when compared with general duty policemen. Sopan et al.,2005 study concludes that the traffic policemen are highly vulnerable for respiratory impairment due to vehicular exhaust at workplace environment.

Singhal et al.,2007 and Levsen et al.,1988 studied particles generated from diesel exhaust are extremelysmall and are present in the nuclei or accumulation modes, with diameters of 0.02 nm and 0.2 nmrespectively. 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. Hence chronic exposure to them can lead to chronic inflammation of respiratory tract and lung parenchyma

The study of Vandana et al.,2015 revealed that respiratory functions including Forced Vital Capacity (FVC), Forced Expiratory Volume in one second and Forced Vital Capacity ratio as percentage (FEV1/ FVC%) were reduced significantly in the traffic policemen than general duty policemen.

Sayyad et al.,2013 studied the effect of air pollution in smoker traffic policemen and found that there is significant decrease in FVC (P<0.01), FEV1 (P<0.01),FEF-25-75% (P<0.01), FEF75-85% (P<0.02) and PEF(<0.01) in study group compared to the control group.Significant changes of FVC and FEV1, may be due to small airway obstruction and which was confirmed byFEF25-75% and PEF parameters.

Pravati Pal et al.,2010also observed that FVC values(3.92 $\pm$ 0.13 in Group-I and 3.56  $\pm$  0.11 in Group- II) are insignificantly (P<0.05) reduces in the case group due to irritation in respiratory tract and weakness of respiratory muscles.

FEV1/FVC indicates the condition of the bronchial musculature which correlates with the study of Vijay Raina et al.,2014.In our study FEV1/FVC was statistically insignificant in traffic police men. The studies of Pramila et al.,2014 and Vandana et al.,2015 found that the FEV /FVC ratio was reduced in their study suggesting that they are suffering from both obstructive and restrictive type of disorder in lungs.

The traffic policemen studied might be small in number with respect to total population engaged in this profession but the trend of the results are representative of that population. The limitation of the current study can be inclusion of convenient sample of traffic policemen and this can be attributed to limited time of data collection on work-day for all the respondents who work day after day without any break.

### Study Conclusions:

The results of this study have shown a significant fall in pulmonary function parameters like FVC, FEV1 and PEFR, in traffic policemen, Our study revealed that FVC had been significantly reduced in the traffic policemen suggesting restrictive pattern of lung disease.FEV1 and PEFR were also significantly reduced in traffic police men suggesting obstructive lung disease. FEV1/FVC was statistically insignificant in traffic police men.

### General Conclusions:

Awareness must be created in the public regarding the harmful effect of traffic air pollution and advice should be given to switch off the engine in traffic queue. Government should make a provision of compulsory use of protective equipment (eg. nose air filter masks) by traffic policemen working at heavy traffic junctions.

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