



## BREATHING LIFE OF TRAFFIC POLICE:A CLOSE LOOK ON PULMONARY FUNCTION TEST USING SPIROMETRY

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### ABSTRACT

**Introduction:** Air pollution due to automobile exhaust is increasing constantly over the ages. Traffic police personnels are highly vulnerable to the respiratory morbidities and mortality. In spite of the high vulnerability there are only few studies that have been done on them in Tumkur city. The present study was aimed at assessing the pulmonary function tests by using spirometry. **Material and Methods:** This was a cross-sectional observational study conducted in Tumkur city over a period of one year from 21 Sept 2021 to 20 Aug 2022. To evaluate the impairment of PFT values in 50 traffic police personnels. Pulmonary functional assessment was done using computerised software of spirometry. **Results:** Traffic personnel showed reduced lung volumes in the forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and maximum voluntary ventilation (MVV) when compared with normal predictive values. FVC, FEV1, MVV showed statistically significant ( $p < 0.05$ ) reduction among the other parameters of PFT. Traffic personnel with longer duration of exposure showed significantly reduced lung volumes. Smokers did not show significant decrease ( $p < 0.05$ ) in lung function when compared to non-smokers. **Conclusion:** It is concluded that longer duration of exposure to automobile exhaust and absence of appropriate personal protective equipment like respirator masks during duty hours among the traffic police personnels leads to reduction in lung functions mainly restrictive type of lung impairment.

**KEYWORDS :** Pulmonary Function Test (PFT), Traffic Police Personnel, forced vital capacity (FVC), Forced expiratory volume in one second (FEV1), maximum voluntary ventilation (MVV).

### INTRODUCTION

The health of people is seriously threatened by air pollution brought on by traffic. Air pollution due to automobile exhaust is increasing constantly over the ages. Traffic police personnel are highly vulnerable to the respiratory morbidities and mortality.<sup>1</sup> The primary causes of outdoor pollution include emissions from motor vehicles, fuel combustion, and engine heating. In India, motor vehicles including cars, trucks and buses are the main causes of air pollution<sup>2</sup> and they are also the main cause of air pollution in our city of Tumkur. The traffic police are exposed to extremely high amounts to this type of air pollution. Due to the lack of research in our Tumkur region, it was necessary to investigate pulmonary function abnormalities among traffic police personnels.

Police officers who work in traffic are frequently exposed to the harmful chemicals that are released from motor vehicles, making them extremely susceptible to occupational lung disorders. Asthma, wheezing, shortness of breath, a dry cough, and other nasal issues are the most frequently reported respiratory complaints among traffic police as a result of air pollution. Polluted air due to motor vehicles exhaust, the blowing of dust into the air by a fast vehicle etc., put traffic police officers through physical respiratory effort. Chronic coughing, shortness of breath, and wheezing are all serious respiratory problems that are brought on by petroleum products and their emissions.<sup>1,2</sup> They significantly increase the inflammatory response in the lungs when present in high quantities. The extremely tiny particles produced by gasoline exhaust are found in the nuclei or accumulation modes and have sizes of 0.02 nm to 0.2 nm, respectively.<sup>3</sup> Additionally because of their surface area, they have the capacity to carry significantly higher concentrations of harmful substances like metals and hydrocarbons on their surface. When compared to large sized particles, tiny particles can stay airborne for longer lengths of time, deposit in more places and go deeper into the lungs. They can remain airborne for longer periods and deposit in greater numbers and deeper into the lungs.<sup>3</sup> Exposure to diesel exhaust can cause immediate side effects as eye and nose irritation, altered lung

function, headache, fatigue, and nausea. In addition to organic petrol compounds and vehicle exhaust.

Another major element of the air pollution brought on by vehicle exhaust emissions is carbon monoxide. When carbon monoxide levels reach a certain point, it displaces oxygen from the hemoglobin molecule and forms carboxy-hemoglobinemia which results in hypoxia and finally death<sup>4</sup>

Pulmonary function tests (PFT) is a noninvasive diagnostic tests that provide measurable feedback about the function of lungs. An assessment of lung volumes, lung capacities and flow rates of expired air provide specific information for clinical diagnosis and research purposes.<sup>5</sup> Due to the nature of their profession and the environment in which they operate, traffic police officers are constantly exposed to harmful car exhaust fumes. An accurate assessment of the lung volumes and flow was made by utilizing a computerized spirometer, which helps in the early detection of lung function impairment. Moreover, there is a possibility to detect pulmonary disease only by periodic retesting in the earliest stages when preventive or corrective measures are more likely to be beneficial.<sup>6,7</sup>

This study aims at understanding how much would be the exposure to these pollutants affect the breathing of traffic police personnel who are working on roadways as a part of their duties. This study also aims at assessing the pulmonary functions after longer duration of exposure

### MATERIALS AND METHOD

**Study subjects:** The study was conducted in 50 traffic police personnel in Tumkur region.

#### Inclusion Criteria

- Traffic police personnel
- Age above 25 years
- Both male and female officers.
- Experience on duty for more than 5 years.

#### Exclusion Criteria

- Police personnel working at office.
- Traffic police personnel with previous history of respiratory illness (asthma, TB, COPD) and chest injuries, surgeries, cardiac failure before joining the job.

**Study Period:** Duration of 1 year from 21 Sept 2021 to 20 Aug 2022.

**Instrument Used:** The present study was done using computerized software of pulmonary function testing using spirometry.

**Procedure for Spirometry**

Subjects were made to sit comfortably in arm chair with straight back. Procedure was demonstrated to the subject. The subjects were asked for deep inhalation of atmospheric air and nose clip was placed immediately. The lips were tightly wrapped around spirette to keep it inside the mouth. The subjects were instructed to blow air as quickly and forcefully as they can for a minimum of 6 seconds. Then immediately ask the subject to inhale deeply with spirette still inside the mouth. Minimum of three trials was done with an interval of 5 minutes between each trails. Best of 3 trials is taken for analysis of Pulmonary function parameters were compared with normal values. Assessment of duration on exposure among the subject by using Anova test and correlation was done using Pearson's correlation coefficient test.

**RESULTS**

The study was done among 50 traffic police personnel who have worked in the Tumakuru city.

Out of 50 participants, 45 were male and 5 were female. Most of them belonged to the age group of 25-50 years



Figure 1: Study Participants

Age-wise split of male and female subjects: Among 45 male- 5 belonged to <25yrs, 25 were in age group of 25-50, remaining 15 subjects were >50 years. In this study including 5 female, 1 was in group of <25yrs, 3 were in 25-50 years, 1 was over the age of 50 years.

Table 1:Age-wise Split Of Male And Female Subjects

Age	MALE	FEMALE	Total
<25	5	1	6
25-50	25	3	28
>50	15	1	16
Total	45	5	50

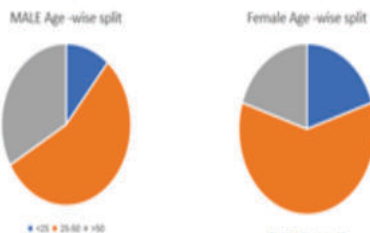


Figure 2:Age-wise Split Of Male And Female Subjects

**Inference Based On Smoking History**

Out of 50 traffic police personnel, 34 never smoked, 10 officers were former smokers and 6 were current smokers.

Table 2: Inference Based On Smoking History

*Inference based on smoking history*

Smoking History	Normal	Restriction	Mild Obstruction	Moderate Obstruction	Severe Obstruction	Total
Current	3	3	0	0	0	6
Former	2	5	1	1	1	10
Never	12	11	5	6	0	34
TOTAL	17	19	6	7	1	50

Out of 34 non-smokers, 12 had normal Pulmonary function test, 11 had restrictive type of PFT, 5 were having mild obstruction and remaining 6 showed moderate obstruction in the PFT spirometry reports.

Among the 10 former smoker police officers, 2 of them had normal PFT, 5 showed restrictive pattern, 1 of them had mild obstruction, 1 had moderate obstruction and 1 of them had severe obstruction.

Among the 6 current smoking police officers, 3 had normal PFT, 3 had restrictive pattern.

**Inference Based On Year Of Experience On Duty**

It was also observed that as the number of years at work increased, there was impairment in the lung function.

It was also observed that there was more of a restrictive type of pattern

Table 3: Inference Based On Experience Group

*Inference based on year of experience on duty*

Experience (Binned)	Normal	Restriction	Mild Obstruction	Moderate Obstruction	Severe Obstruction	Total
<10	1	5	0	1	0	7
11 to 30	8	6	5	4	0	23
31+	8	8	1	2	1	20
TOTAL	17	19	6	7	1	50

**Inference Based on PFT Values**

We observed that FVC and MVV were decreased in traffic policemen

This shows that there is some degree of restriction present in them limiting the lungs to expand. The changes might be in the tissues of the lungs due to chronic irritation by pollutants.

Table 4: P values of PFT Parameters

	PREFERENCE	N	Mean	Std. Deviation
FEV1	Normal	17	2.9147	.57024
	Restriction	19	2.4605	.41361
	Mild obstruction	6	2.2363	.68637
	Moderate obstruction	7	2.2214	.40371
	Severe Obstruction	1	1.0100	-
FVC	Normal	17	3.4159	.68962
	Restriction	19	3.0568	.49071
	Mild obstruction	6	3.4500	1.34915
	Moderate obstruction	7	3.2043	.65886
	Severe Obstruction	1	1.4900	-
%FEV1	Normal	17	.8429	.07244
	Restriction	19	.8000	.04497
	Mild obstruction	6	.6963	.12640
	Moderate obstruction	7	.6886	.05521

	Severe Obstruction	5	6800	-
PEF	Normal	17	10 7465	15 00969
	Restriction	19	5 8632	1 80140
	Mild obstruction	6	5 2300	2 59679
	Moderate obstruction	7	6 6414	1 91597
	Severe Obstruction	5	1 1000	

Table 5: P values of PFT Parameters

		Sum of Squares	df	Mean Square	F	P
FEV1	Between Groups	6.094	4	1.524	5.894	.001
	Within Groups	11.632	45	.259		
	Total	17.726	49			
FVC	Between Groups	4.809	4	1.117	2.124	.093
	Within Groups	23.472	45	.520		
	Total	28.141	49			
%FEV1	Between Groups	.183	4	.046	3.396	.000
	Within Groups	.219	45	.005		
	Total	.401	49			
PEF	Between Groups	305.831	4	76.458	325	.458
	Within Groups	3718.807	45	82.643		
	Total	4024.638	49			

**DISCUSSION**

The study involved 50 participant of traffic police of tumkur city conducted over a period of 1 year from 21 Sept 2021 to 20 Aug 2022.

Studies on occupational morbidity in India have primarily focused on industrial workers who were exposed to workplace dangers. Less attention has been paid to workers who are consistently exposed to high levels of ambient air pollution because of the nature of their jobs.<sup>18</sup>

Among the subjects 90% were male, 10% were female. Based on their age on duty among males, <25 yrs were 11.11%, 25-50 yrs were 55.55%, >50 yrs were 33.33%. Based on their age on duty among females, <25 yrs were 20%, 25-50 yrs were 60%, >50 yrs were 20%.

Among the 50 participant never smoked were 68%, former smoker were 20% and current smoker were 12%.

On the study of pulmonary function test of the traffic personnel with current smokers 50% had normal PFT and 50% showed restrictive type of breathing. PFT among former smoker included 20% had normal type, 50 had restrictive type, 10% had mild obstruction, 10% moderate obstruction and severe obstruction. Among the non smokers 35.29% were normal, 32.35% were restrictive type, 14.70% were mild obstructive type, 17.64% were moderate obstructive type.

The primary job of the lung is to absorb oxygen from the inspired air and exhale carbon dioxide in order to keep the arterial blood carbon dioxide and oxygen concentrations within the normal range. The primary processes for achieving this goal are perfusion, diffusion, and breathing.<sup>16</sup>

As indicated in Table 4, we noticed that traffic policemen's FVC and MVV were lower. This demonstrates that there is some degree of constriction that prevents the lungs from expanding. The lungs tissues may have changed as a result of ongoing irritation from pollution.

Sulphur dioxide and Nitrogen dioxide are more likely to enter the deeper layers of the lungs along with contaminant particles. These gaseous contaminants change the characteristics and concentration of surfactant in alveoli which may lead to the early closure of smaller airways.<sup>16</sup>

As seen by P values for FEV1 in Table 5, the majority of the terminal bronchioles may be damaged before other lung function tests like FEV1 are impacted.

The body is exposed to numerous contaminants, including ozone, carbon monoxide, nitric oxide, sulfur dioxide, and

particulate matter which may be the cause of this reduction in lung function measures. Chronic bronchitis, emphysema, fibrotic lung diseases and lung cancer are thought to have their roots in the oxidative stress that results from these conditions.<sup>17</sup>

The forced vital capacity (FVC) and forced expiratory volume in first second (FEV1) of traffic police officers was decreased as in comparison to expected normal values. This exhibits a degree of respiratory limitation which is evident among the traffic police officers. The modifications may reside in the lung tissue as a result of ongoing inflammation by contaminants. In our study FEV1 of the traffic police was lower.

According to the subjects, there was some blockage at the time of expiration. FEV1/FVC represents the the health of the bronchial muscles. Any of these factors combined with the respiratory muscle weakening impact brought by carbon monoxide effects explains the considerable decline in factors of pulmonary function test, particularly restrictive pattern type of the lung disorder was seen in our study.

**CONCLUSION**

Prolonged duration of exposure to chemicals, gases and fumes present in the environment near heavy traffic area are harmful for the lungs. It decreases the various lung functions that results in the alteration in pulmonary function test parameters as reported by our study.

In our study smoking did not have a predominant effect on the decline in lung function parameter.

Our study suggested that prolonged duration of exposure to air pollution was the major contributing factor for the decline in their lung function.

From the values of present study, it is recommended that traffic police personnel should

1. Compulsory use of protective equipment (eg, nose masks during duty hours to prevent exposure to automobile exhaust.
2. Exposure should be quantitated periodically by calculating exposure index for duration of duty.
3. Imparting health education and conducting regular medical checkups for assesment of traffic police personnels working at heavy traffic junctions.
4. Intensive promotion of electrical vehicles by Govt. agencies.

The limitations of our study includes, further study on correlating air quality index with exposure index and study of PFT abnormalities of individual respirstory diseases were not studied.

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