RESEARCH ARTICLE

Comparative Study of Lung Function Test of Policemen in Traffic Control with those in General Duty

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ABSTRACT

Background: Traffic policemen are in outdoor environment exposed to dust and other pollutants without any preventive measures making them susceptible for compromised lung functions with time being.

Aims & Objective: Examination and comparative analysis of effects of exposure to environmental pollution on PEFR, MVV, FEV1, FVC between policemen in traffic and General duty in Dhule, Maharashtra.

Materials and Methods: The Study was carried out from 1st to 30th November 2011. Study group included 50 traffic policemen and 60 policemen in general duty. Subjects were selected randomly with age, height and weight matched from nonsmoker policemen's fulfilling inclusion criteria's.

Results: Group A policemen had statistically significant ($p<0.01$) lower levels of FVC, FEV1, PEFR, MMV values compared to their predictive values. Policemen in Group A had lower FVC by 0.32L, FEV1 by 0.21L/min and FEV1/FVC ratio was higher by 6.8% than the Group B ($p<0.01$).Percent to the predicted of value of FVC & FEV1 was lower by 11.8% and 10.2% respectively while FEV1/FVC ratio was 7.3% greater than Group B policemen ($p<0.01$). Forced vital capacity (FVC) of 30.8% was mildly reduced and in 17.3% it was moderately affected in Group A.

Conclusion: There is significant decrement in lung function parameters in the traffic policemen in both the groups with more reduction in those regularly exposed to vehicle exhaust as compared to others.

KEY WORDS: Lung Function Test; Traffic Policemen; FVC; FEV1; PEFR; MVV

INTRODUCTION

Today's urban streets environment is polluted by vehicular exhaust due to poor ventilation and the number of vehicles have increased and manual vehicles (bicycles, carts, tongos etc.) have been replaced by automobiles working on petrol and diesel fuels. They emit hydrocarbons, carbon monoxide, lead, nitrogen oxides and particulate matters. Carbon monoxide is one of the common and widely distributed air pollutants produced by incomplete combustion of carbon containing materials such as in automobiles. Coarse particle of size more than 2.5 µm usually contains earth's crustal material and fugative dust from vehicular source mainly. Smaller particles less than 2.5 µm contain secondarily formed aerosols, combustion particles and recondensed organic and metal vapors. There are solid particles, liquid droplets etc floating in the air and remain in suspension state in troposphere.[1]

The National Air quality Monitoring Programme, in major cities in India showed that suspended particulate matters (SPM) exceed the standards in all of these cities most of the time throughout the year over last 14 years. Many disease of occupational origin require months or years for their development. Their slow development very often leads to their non –recognition in the early stages and this is harmful to the workers.[2]

Exposure to traffic related Air pollution is found to increase human respiratory and cardiovascular mortality and morbidity[3,4], reciprocated in the decrement in the lung function[5]. Police recruits undergo rigorous training by which they achieve high level of physical fitness. It is the necessity of their occupation in order to secure and control the society. This physical status is needed to be maintained throughout their profession. Relatively high level of physical fitness, which the policemen's possess, assures a normal lung function and fat free body that is needed to be followed with their job duration.
Authoritarian management styles, poor interpersonal relationships, lack of adequate personal time, 10-12 hours daily shift schedules that disrupt normal sleep patterns and social life, are few stressors faced by members of the police force.[6]

Relatively high concentrations of exposure of traffic fumes affects urban workers such as traffic policemen, street sweepers, postal workers, and newspaper vendors, indicating health risks related to outdoor environment.. Traffic policemen are in outdoor environment exposed to dust and other pollutants without any preventive measures makes them susceptible for compromised lung functions with time being.[7]

Being the part of most physically active occupation the physical status needed to be assessed after being in occupation. So the present study was undertaken with the objectives to assess and compare Lung function test between policemen in traffic control duty with those on other duties.

MATERIALS AND METHODS

The present comparative study includes randomly selected 50 male policemen from those engaged in traffic control in "Group A" and the "Group B" includes 60 policemen working for crime detection, bandobast (security), police station wireless operators, in control rooms and patrolling thus involving all those in non-traffic control job in Dhule city, Maharashtra. Both the groups were investigated during period of 1st to 30th November 2010.

Strict inclusion criteria was followed which included - age group of 31 to 45 years, job period above 3 years, non-smokers. Subjects suffering from respiratory disorders spinal or thoracic deformities were excluded from the study. Both groups included age, height and weight matched subjects fulfilling inclusion criteria's.

Assessment of Health Status

Participants underwent detailed direct interview, providing information of chronic respiratory symptoms, cigarette smoking, exercise history & occupational exposure along with complete

physical examination. Respiratory symptoms were considered related if the respondent reported having the symptom every day or almost every day during the preceding 4 weeks. Spirometric test was done in between 9 to 11am in Clinical Physiology laboratory in accordance with the guidelines of pulmonary function measurements by the American Thoracic Society.[8]

Subjects performed tests on the electric auto spirometer (Medspiror machine, RMS Chandigarh) in the sitting position with nose clip. After demonstrating the required manure in group, test results were noted after performing acceptable technique 3 times and the highest value was taken.

The following parameters recorded: forced expiratory volume (FEV), forced expiratory volume in 1 second (FEV1) forced vital capacity (FVC), vital capacity (VC). The FEV1/FVC ratios were calculated as percentages. Means and standard deviations (s) were calculated. Values obtained were also compared with the predictive Indian standards for that age, sex, height and weight at BTPS. The severity of lung function was graded as Normal (>80%), Mild (61% to 80%), Moderate (41% to 60%), severe abnormality (<40%).[9]

RESULTS

The study included policemen of 30 – 45 years of age with median job tenure of 8 years. The background data showed no significant differences between the Group A and Group B with regard to age, addiction or residence. Median job tenure of Policemen in Group A working in traffic control is 8 years and those in Group B working in general (non-traffic control) duties is 7.6 years. It was found that upper respiratory symptoms such as sneezing, rhinitis, phlegm or stuffed nose was regularly experienced by 19% Group A while only 5% of those in Group B had such history.

As shown in table 1, there was statistically no significant ($p>0.05$) difference in the age group and duration in service of policemen's in Group A and Group B.

The Group A policemen had FVC & FEV1 value are 77% & 87.2% of their predicted values respectively. It was found that FEV1/FVC ratio and FEF 25% to 75% of traffic policemen was 92.1% and 4.06L respectively. The PEFR and MMV of these Group A policemen was 8 L/min & 122.4L respectively that were 89.5% and 91.5% of the of the respective predictive values. Group B policemen which served as control had 2.9L FVC, 2.6L FEV1, 87.3% FEV1/FVC ratio, 3.31 L FEF25% to 75%, 7.5L.min PEFR and 125.3L MMV values. In Group B policemen the observed value of Lung function test more than 88 % (Table 2).

Table-1: Characteristics of the Traffic Policemen

Characteristics		Group A N=50 No's (%)	Group B N=60 No's (%)
Age (Yrs)	25-30	24 (48%)	26 (43.33%)
	31-35	15 (30%)	20 (33.33%)
	36-40	11 (22%)	14 (23.33%)
Duration of Service (Yrs)	3-6	12 (24%)	16 (26.7%)
	6-9	23 (46%)	27 (45%)
	9-12	15 (30%)	17 (28.3%)

Table-2: The Predicted, Observed Values and Percent of Predicted Values in Mean (S.D) of Lung Function Parameters in Both Groups

Parameters		FVC (L)	FEV1 (L/sec)	FEV1/ FVC (%)	FEF 25%-75%	PEFR (L/min)	MVV (L)
Group A	Predicted	3.4 (0.27)	2.9 (0.21)	83 (1.4)	4 (0.24)	8.9 (0.36)	135.3 (7.2)
	Observed	2.6 (0.42)	2.5 (0.42)	92.1 (11)	4.06 (1.11)	8 (0.93)	122.4 (25.1)
	Percent of Predicted	77 (10.9)	87.2 (8.4)	112.7 (10.8)	100 (27)	89.5 (9.5)	91.5 (13.4)
Group B	Predicted	3.3 (0.24)	2.6 (0.29)	81.5 (1.9)	3.7 (0.33)	8.41 (0.51)	131.4 (7.6)
	Observed	2.9 (0.35)	2.6 (0.4)	87.3 (5.5)	3.31 (0.9)	7.5(1.6)	125.3 (17.5)
	Percent of Predicted	88.8 (8.3)	98.9 (13.9)	106.6 (7.5)	90.2 (25.2)	89.2 (20.4)	96.1 (13.2)

Group A and Group B policemen had statistically significant ($p<0.01$) lower levels of FVC, FEV1, PEFR, FEV1/FVC ratio and MMV values compared to their predictive values (Table 3). Forced vital capacity of 30.8% was mildly reduced and in 17.3% it was moderately affected in Group A. Also in Group A policemen, FEV1/FVC ratio in 3.8% had mild reduction and in 1.9% was moderate reduction of ratio to their

Table-3: Comparison of Lung Function Tests in Policemen

Lung Function Tests	Group A (Predicted Vs Observed)		Group B (Predicted Vs Observed)		Mean Difference (Group A Vs Group B)		
	Mean Difference	SD	Mean Difference	SD	Predicted	Observed	Percent of Predicted
FVC (L)	0.78**	0.38	0.37**	0.28	0.08	0.32**	11.81**
FEV1 (L/sec)	0.43**	0.27	0.11**	0.34	0.09	0.21**	10.18**
FEV1/FVC (%)	8.89**	11.27	2.89**	5.18	0.08	6.8**	7.3**
PEFR	1.14**	1.27	1.01**	1.61	0.1	0.02	2.26
MVV (L)	12.88**	24.55	6.13**	17.2	2.87	2.87	3.5

** p value <0.01

predicted values and FEF 25%-75% was noted to be moderately reduced in 17%. It was noted that the observed values of pulmonary function test in 90% Group B policemen's was more than 80% of their predicted standards.

DISCUSSION

Human are exposed to air pollution from road traffic every day mostly outside home while travelling or standing along the busy roads especially during the rush hours. Traffic policemen are at high exposure risk of road traffic related air pollution.

In present study traffic policemen had 0.78L less FVC compared to the general duty policemen with only 0.57L lower FVC levels. FVC is a better health index for long-term (chronic) effects in adults suggesting the amount of damage to their lungs. Measuring the TLC and residual volume (RV) can confirm restriction suggested by Spirometer in them.[10]

In present study 15.4% traffic policemen Forced expiratory volume at end of 1 second (FEV1) was mildly reduced and in 9.6% it was moderately reduced. One of the reason for it may be Respirable particles produce inflammatory changes in small airways, which could be reflected in reduced lung function, particularly in reduced FEV1 (acute or short-term effect).[10] Reduction in the FVC with a normal or elevated FEV_1-to-FVC ratio defines the classification of restrictive lung diseases as assessed by Spirometer.

Increased average levels of Total Suspended particles (TSP) over a 4-days period are significantly associated with decrements in FVC, FEV1 & FEF 25-75%. Also a significant association with 4-days average NO2 concentration was found only with FEF 25-75%. Thus suggesting TSP over period of several days might have stronger impact on lung volume parameters.[11] This supports to the results of significant fall in FVC, FEV1 and FEV1/FVC ratio in the present study.

When particles less than 10um in diameter, NO2, and SO_4 concentration increase it is associated with a decrement in FEV1 & FVC.[6] The expiratory flow at any given expiratory volume is reduced. The mechanism responsible for the reduction in airflow can be bronchial spasm, airway inflammation, increased intraluminal secretions, and/or reduction in parenchyma support of the airways due to loss of lung elastic recoil.

It is been found that Jakarta's traffic police face increased risks of acute respiratory infections and tuberculosis. Almost 30 percent of them had abnormal lung function test, most of those abnormalities are found to be mild.[7]

In traffic policemen there was mild reduction of MVV & PEFR in 17.3% and 13.5% respectively. Reduced FVC in the absence of a reduced FEV_1-to-FVC ratio suggests a restrictive ventilatory problem. Lung function test on Spirometer in 7 (13.5%) traffic policemen showed obstructive changes and 10(19.2%) were having mixed type of abnormalities' pattern at the time of study. Similarly the restrictive pattern with reduced values of VC, FEV1,FEF 25,PIF in Pondicherry study are reported by Pal P et al in traffic policemen.[12]

In Study at Delhi Mean PEFR values among population in high polluted area was lower than that of the lower polluted area.[4]

In the present study lower percent of impaired values was found in traffic policemen. It is reported that pollution due to gases, fumes and dust is associated with chronic bronchitis and decrements of FEV1 also the obstructive pattern along with decrement in FVC is also seen.[5]

Limitations

Ambient air pollutants concentrations were not available at the sites of heavy traffic in the Dhule city. In this study no strict quantitative comparison could be made between personal exposure values and concurrent environmental pollutants concentrations.

CONCLUSION

There is significant decrement in lung function parameters in the policemen in both the groups with more reduction in traffic policemen. Acute and Chronic effect of the outside polluted environment or inactive life style has caused the fall in Lung function parameters of the high physical fitness demanding professionals.

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