A STUDY OF PULMONARY FUNCTION TESTS IN TRAFFIC POLICEMEN IN KOTTAYAM DISTRICT AND NORMAL HEALTHY ADULTS

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ABSTRACT

BACKGROUND

Environmental pollution and human efforts for the betterments of living standards are the two sides of the same coin. In the wake of industrialisation and ever increasing population, the basic amenities of life, that is air, water and land are being polluted continuously. Independent investigations have suggested a possible relationship between chronic exposure to pollutants and poor pulmonary function. This study will contribute to our understanding of effects of air pollution on pulmonary function in traffic policemen and the need for regular medical check-ups and adopting preventive measures.

MATERIALS AND METHODS

A case-control study was done by conducting three medical camps at AR Camp, Kottayam. All subjects under study were divided into three categories and a medical checkup was conducted to rule out medical illness and to collect anthropometric details. The pulmonary function tests carried out in this study using a portable spirometer are FVC, FEV1, FEV1%, FEF25-75% and PEFR. Data analysis was done using independence sample t-test and chi-square test in SPSS of windows version 10.

RESULTS

Higher prevalence of respiratory symptoms in traffic policemen compared to other groups. All three groups had normal pulmonary function status. Lower values of FEV1, FVC, FEV1/FVC, PEFR and FEF25-75% were obtained in traffic and non-traffic policemen compared to healthy adults. PFT values were lower in traffic police exposed for longer periods. There is lesser amount of air pollution in Kottayam compared to other cities.

CONCLUSION

There is no significant decline in lung function in the exposed group of traffic police. Lower values in PFT in non-traffic police was due to indirect exposure to pollutants as they were inmates of AR camp, which is located at the centre of Kottayam town. The normal controls were mainly labourers and agriculturists of rural area.

KEYWORDS

Pulmonary Function Test, Traffic Police, Air Pollution.

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BACKGROUND

Environmental pollution and human efforts for the betterments of living standards are the two sides of the same coin. In the wake of industrialisation and ever increasing population, the basic amenities of life, that is air, water and land are being polluted continuously. Independent investigations have suggested a possible relationship between chronic exposure to pollutants and poor pulmonary function. Air pollution is generally a disequilibrium condition of air caused due to the introduction of foreign elements from natural and man-made sources to the air, so that it becomes injurious to biological communities. Traffic police are exposed to immense vehicular air pollution. These pollutants (SO_2, NO_2, SPM, PAH compounds) produce detrimental effects on pulmonary function resulting in obstructive or restrictive diseases.[1,2] The ultrafine particles can easily enter blood vessels and affect respiratory as well as cardiovascular systems.[3,4,5,6] In many towns and cities, it is found that diesel exhaust particles account for highly significant percentage of particles emitted from the motor vehicles. Acute effects of diesel exhaust exposure include irritation of eyes and nose, change in lung functions, headache, fatigue and nausea. Chronic exposure is associated with cough, sputum production and lung function decrements.[7,8] In many studies, relationship between age, sex, height, weight, body surface area, ethnic origin, smoking habit, occupational exposure, environmental conditions and ventilator function of lungs have been shown. Numerous studies have recorded deterioration in the lung function tests among the auto rickshaw workers, petrol pump workers and roadside workers. Fewer data is available from Indian condition, but

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many cities in India are contributing to immense vehicular pollution.[9] This study will contribute to our understanding of effects of air pollution on pulmonary function in traffic policemen and the need for regular medical check-ups and adopting preventive measures.

OBJECTIVES

1. To study pulmonary function in traffic policemen.
2. To compare pulmonary function in traffic policemen with normal healthy adults and non-traffic policemen.

MATERIALS AND METHODS

Study Design- Case-control study.
Study Setting- AR Camp, Kottayam.
Study Subjects- The subjects under study were divided into 3 groups - Category 1, Normal healthy males, Category 2, Non-traffic police and Category 3, Traffic police.
Sample Size- 248 (Category 1 - 50, Category 2 - 116 and Category 3 - 82).
Sampling Methods- Convenient sampling.
Study Period- One year.

After obtaining permission from institutional review board, the study was conducted over a period of one year during, which three medical camps were conducted at AR Camp, Kottayam in association with Kerala Healthcare Society. Data was collected from 50 male normal healthy volunteers (Category 1), 116 male non-traffic police (Category 2) and 82 male traffic police (Category 3) of age group 20-55 yrs. They did not have any history of smoking, respiratory or medical illness. A case-control study was done. All subjects were subjected to a thorough medical check up to rule out any illness and to collect anthropometric details. Each subject was provided a questionnaire in which he recorded demographic data, health status and consent to participate in the study. Objectives of the study were explained to the subjects and they were familiarised to the machine. All PFTs were done in sitting position and subjects were encouraged to perform up to optimum levels. A nose clip was applied during the entire manoeuver. Three readings were taken at the same time and best out of them was considered for analysis. The instrument used was a portable computerised spirometer called 'Compact Vitalograph' (Figure 1).

Figure 1. Compact Vitalograph

The pulmonary function tests performed during this study are-

- Forced vital capacity.
- Forced expiratory volume in 1st second.
- FEV1/FVC%.
- FEF 25-75%.
- PEFR.

Forced Vital Capacity (FVC) (Figure 2)
It is the volume of air, which can be expired as forcefully and rapidly as possible after maximal inspiration. Normal value is 4.8 L in adult males.

Forced Expiratory Volume (FEVt) (Figure 2)
It is volume of gas expired over a given time interval during the performance of a forced vital capacity. The time interval is stated in seconds as a subscript to FEV, e.g.- FEV1, FEV2, FEV3, etc. it is normally expressed in litres and time in seconds.

FEV1/FVC Ratio or % (Figure 2)
A normal individual can expire 83% of expiratory volume in first second, 94% in second and 97% in third second. In obstructive diseases, the ratio will be lowered and in restrictive diseases it will be normal or increased.

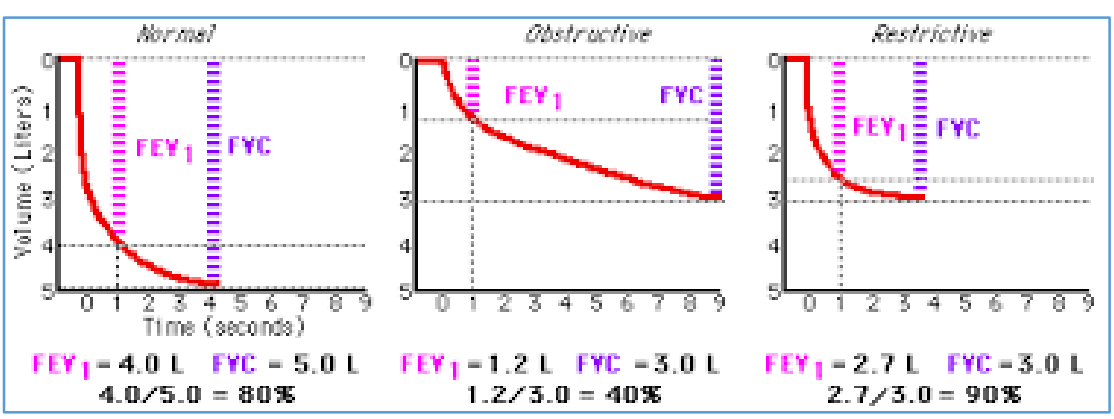

Figure 2. FEV1/FVC Ratio or %

Forced Mid Expiratory Flow Rate (FEF 25-75%) (Figure 3)
It is the mean forced expiratory flow during the middle half of the FVC. It is expressed in litres/second. It indicates airflow from small airways.

Peak Expiratory Flow Rate (PEFR) (Figure 3)
It is the maximum flow rate attainable at any time during a forced expiratory effort. It is recorded in litres/second or litres/minute. Normal value is 450-600 L/minute.

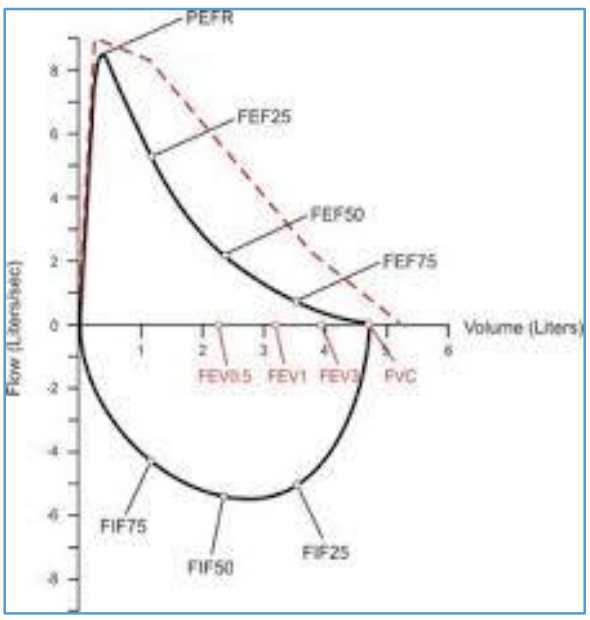

Figure 3. Forced Mid Expiratory Flow Rate

RESULTS
For statistical analysis, SPSS version of windows version 10 was used. Association among variables was assessed using independence sample t-test and prevalence of respiratory symptoms among the groups was assessed by chi-square test. The mean age of category 1 was 32 yrs., category 2 was 34 yrs. and category 3 was 35 yrs. The mean height of category 1 was 168 cm, category 2 was 170 cm and category 3 was 172 cm. The mean weight of category 1 was 61 kg, category 2 was 73 kg and category 3 was 72 kg. The prevalence of respiratory symptoms among traffic police is given in figure 4 and non-traffic police in figure 5, respectively.

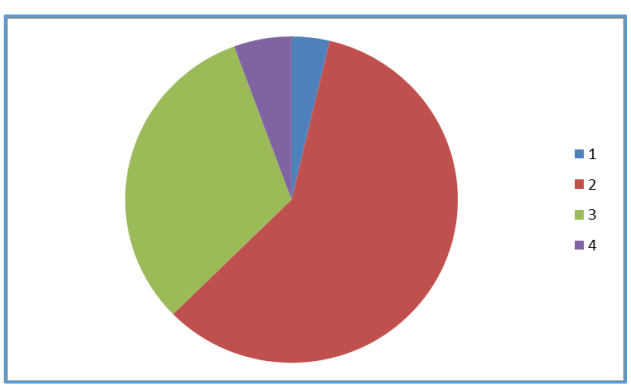

Figure 4. Respiratory Symptoms among Traffic Police

1 - 4.8% asymptomatic; 2 - 76.8% nasal symptoms; 3 - 41.4% non-productive cough; 4 - 7.3% wheeze.

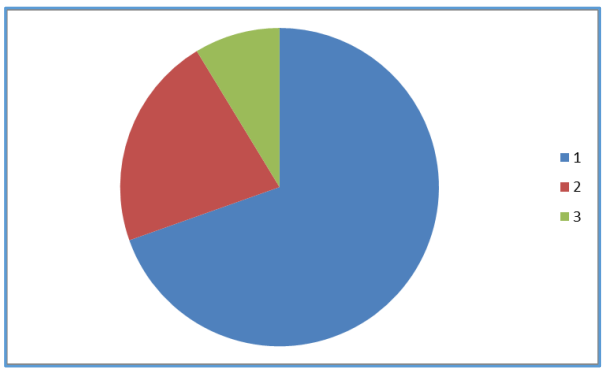

Figure 5. Respiratory Symptoms among Non-Traffic Police

1 - 69.8% asymptomatic; 2 - 21.5% nasal symptoms; 3- 8.6% non-productive cough.

Analysis of PFT Parameters
The various PFT parameters analysed were-

- Forced vital capacity.
- Forced expiratory volume in first second.
- FEV1/FVC%.
- FEF 25-75%.
- PEFR.

	Category	N	Mean	P value
FVC%	1 2	50 116	94.154 89.241	0.01 S
FEV1%	1 2	50 116	96.452 94.931	0.46 NS
FEV1/FVC%	1 2	50 116	85.61 88.04	0.04 S
PEFR	1 2	50 116	110.53 96.58	0.00 HS
FEF 25-75%	1 2	50 116	94.74 93.31	0.72 NS

Table 1. Shows the Comparison of PFT Parameters in Category 1 and 2. It is Found that there was Significant Change in FVC, FEV1/FVC and PEFR Values among Normal and Non-Traffic Police

	Category	N	Mean	P value
FVC%	1 3	50 82	94.154 88.33	0.003 S
FEV1%	1 3	50 82	96.452 93.36	0.14 NS
FEV1/FVC%	1 3	50 82	85.61 87.37	0.04 S
PEFR	1 3	50 82	110.53 97.17	0.00 HS
FEF 25-75%	1 3	50 82	94.74 92.56	0.6 NS

Table 2. Shows the Comparison of PFT Parameters in Category 1 and 3. It is Found that there was Significant Change in FVC, FEV1/FVC and PEFR Values among Normal and Traffic Police

	Category	N	Mean	P value
FVC%	2 3	116 82	89.24 88.33	0.57 NS
FEV1%	2 3	116 82	94.93 93.36	0.4 NS
FEV1/FVC%	2 3	116 82	88.04 87.37	0.3 NS
PEFR	2 3	116 82	96.58 97.17	0.8 NS
FEF 25-75%	2 3	116 82	93.31 92.56	0.8 NS

Table 3. Show the Comparison of PFT Parameters in Category 2 and 3. It is Found that there was no Significant Change in Values Among Non-Traffic and Traffic Police

Duration	N	Mean Age	FVC	FEV1	FEV1/FVC	PEFR	FEF 25-75%
0-5 yrs.	46	34	88.66	93.9	87.5	98.18	93.9
5-10 yrs.	36	35	83.61	86.2	85.3	88.25	79.77

Table 4. Show the Comparison between Duration of Exposure to Air Pollution and PFT Values in Traffic Police Significant Decline in Lung Function was Observed on Longer Duration of Exposure

	Permissible Level	Kottayam	Mumbai	Delhi	Chennai	Kochi
NO ($\mu g/m^3$)	9	6.47	19.89	31.06	12.6	7.7
SO2 ($\mu g/m^3$)	4	22.73	38.32	31.14	13.33	33.35
SPM ($\mu g/m^3$)	100	76.98	190.6	400	143	114.48

Table 5. Shows Comparison of Air Quality of Kottayam with Other Cities in India

DISCUSSION

The comparison did not give statistically significant results. There was no significant decline in lung function in the exposed group, but a higher prevalence of respiratory symptoms like rhinitis, sneezing, persistent non-productive cough and mild wheeze was noted in traffic police. One reason for normal PFT in traffic police is the long latent period of many respiratory diseases associated with occupational hazards. Similar studies conducted in various other cities with similar results have stressed on the need for longer follow up (25-30) yrs. Second reason is that traffic police complaining of increased symptoms were transferred to other departments, so longer duration of exposure was prevented. Third reason is that when compared to other cities Kottayam town has less air pollution as per data obtained from pollution control board. Lower values in PFT in non-traffic police was due to indirect exposure to pollutants as they were inmates of AR Camp, which is located at the Centre of Kottayam town. The normal controls were mainly labourers and agriculturists of rural area.

However, there are other studies contrary to the results of current study. In a study done by Gamble et al,[10] the chronic effects of diesel exhaust on respiratory system in 283 diesel bus garage workers is mentioned. There was statistically significant decrease in all PFT except maximum mid expiratory flow rate. In another study on petrol station workers, a decline in FVC and FEV1 was reported, but most affected parameter was FEF 25-75%.[11] Similar findings have been reported by various other authors.[12-16]

In another study, pulmonary function in traffic policemen working in the urban areas was compared to rural areas and significantly lower values were found in urban traffic police. The reason could be increased vehicular density and pollution in urban areas compared to more of green plantation in the rural areas.[17-18] It is also concluded that there is strong correlation between duration of exposure to air pollution and pathogenesis of airway disease and that levels of air pollution have adverse effects on respiratory tract. Rajkumar[19] has reported higher morbidity in auto rickshaw drivers due to exposure to air pollution in his study conducted in Delhi. Periodic checkups and transfer to other sections of the department are some of the remedial measures.

CONCLUSION

There is no significant decline in lung function in the exposed group of traffic police. Lower values in PFT in non-traffic police was due to indirect exposure to pollutants as they were inmates of AR Camp, which is located at the centre of Kottayam town. The normal controls were mainly labourers and agriculturists of rural area.

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