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Original Article

Exposure of vehicular pollution in altering the pulmonary functions in traffic policemen in Multan city

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Abstract

The objectives of this study was to assess the effect of traffic air pollution on the pulmonary functions among the traffic policemen and general policemen posted at various chowks and police stations respectively in Multan city. Pulmonary function test (PFT) were recorded on the basis of age, smoking history and body mass index (BMI) matched 50 traffic policemen (study case group) and 50 general policemen (control group) of male category. In altering lung function, chronic smoking was known to be a critical factor. Between the smokers as well as non-smokers of both the groups, pulmonary function test parameters were compared. In non-smokers group, significant decreased was found to be in vehicle control (VC) (4.54±0.12), peak inspiratory flow (PIF) (192.4±15.29), forced expiratory flow (FEF-25) (6.04±0.68) and forced respiratory volume in 1 second (FEV_1) (3.97±0.11) in study case group as compared to that of control group. Similarly, in smokers group, significant decrease was found to be in VC (4.26±0.11), peak expiratory flow (PEF) (78.62±2.42), forced respiratory volume in 1 second (FEV_1) (3.45±0.09), FEF-25 (5.28±0.23), maximum voluntary ventilation (MVV) (87.4±4.69) and PIF (238.6±14.33) in study case group as compared to that of the control group. These changes showed that in the traffic policemen group restriction to the lung expansion, narrowing of the air ways and obstruction were to be found as compared to the general policemen group. Decreased functional capacity of the lungs and chronic smoking worsens the condition are due to the exposure to vehicular pollution for several hours in a day for many years.

Key words: Pollution, pulmonary function test, smokers, non-smokers, body mass index, policemen

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INTRODUCTION

Increase in industrialization, energy use and urbanization creates pollution problems through the activities of economic development (Razzaque, 1993). A significant role in the development of allergic respiratory diseases such as rhinitis and asthma believed to be play by environmental factors. From vehicular emission the presence of various gases and particles like nitrogen dioxide, benzene, sulphur, nitric oxide, black smoke and lead etc. may play a vital role in the respiratory diseases. The gases and toxic chemicals which are released from vehicular emission produce allergy and irritation in the lungs and for a long time the air passage exposed to them. For years together in the busy traffic signal areas traffic policemen get exposed to the vehicular emission. The lung functions of those individuals are reported to be damaging due to the presence of particles, chemicals and fumes in the emission (Pravati *et al.,* 2010). By recording different pulmonary function test (PFT) parameters most studies have been conducted to assess the respiratory health status of individuals exposed to pollution (Valic *et al.,* 1973).

In areas with high levels of air pollution Evans *et al.* (1988) investigated the different effects of emission from the internal combustion engine on respiratory symptoms and pulmonary function in men which were collecting tolls and directing traffic. They also investigated significantly lower FVCs (forced vital capacities) and lower FEV_1s (forced expiratory volume at one second) higher carboxyhaemoglobin levels and respiratory symptoms in tunnel officers than the bridge workers. A significant difference in peak expiratory flow rate (PEFR), FVC and FEV_1 between control subjects and traffic wardens in

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some studies of Nigerian traffic wardens performed by Ogunsola *et al.* (1994). In another study, the mean levels of FEV_1 and maximum rate of respiratory flow in 25% vital capacity (V_{25}) were found to be significantly lower when height, age and smoking incidence were matched with general policemen group (Karita *et al.,* 2001).

In all over the world, many studies on air pollution have been conducted but limited studies in Pakistan especially in Multan has been conducted in traffic policemen to show its effects in regarding to pulmonary function parameters. Therefore, this study was conducted to show the effects of air pollution on traffic policemen group and general policemen group of Multan (Punjab) Pakistan.

MATERIALS AND METHODS

This study was made out in 50 traffic policemen (study case group) at various chowks and 50 general policemen (general group) posted at various police stations of Multan city. From all the subjects written informed consents were obtained. All the subjects in study case group and control group were males. The study case group (traffic policemen group) were between 25 to 45 years of age and they were working as traffic policemen in busy traffic areas for a period of minimum 3 years. Similarly, the control group (general policemen group) were also between 25 to 45 years of age and they were working as general policemen at various police stations for a period of minimum 3 years. For the calculation of the body mass index (BMI), body weight and height were measured. In the outdoor department of civil hospital, primary screening was done to find out any anatomical deformity of the chest or spine which may affect any respiratory parameters. Subjects having any gross pulmonary or lung diseases were excluded from this study. On the basis of age, smoking history and body mass index (BMI) matched the subjects were further divided into non-smoking and smoking group. In each (non-smoking and smoking) group 20 subjects were placed. In data sheet was kept confidentially for each subject in the form of questionnaire. With the help of a computerized Microlab Spirometer of Micro-Medical Limited of Rochester, England, pulmonary function test (PFT) was carried out. By this spirometer, the following parameters were recorded. VC (vital capacity), FEV_1, FEF 25% (forced expiratory flow at 25% of volume as a percentage of VC), FEF 50% (forced expiratory flow at 50% of volume as a percentage of VC), FEF-75% (forced expiratory flow at 75% of volume as a percentage of VC), MVV, PIF, PEF, FEF25-75 (forced expiratory flow at 25-75% of volume as a percentage of VC), FIF50 (forced inspiratory flow at 50% of inhaled volume) and TV (tidal volume). The collected data were analyzed with the help of Students't' test and the values obtained were expressed as Mean ±SE.

RESULTS

Between the control group and study case group, the body weight, height, age and body mass index (BMI) were compared. No significant difference between control group and study case group was to be found (Table I). Similarly, between non-smokers of general policemen and that of traffic policemen comparison was made. Significant decrease in vital capacity (VC=$P<0.05$), forced expiratory volume in one second (FEV_1=$P<0.01$), forced expiratory flow at 25% of volume as a percentage of VC (FEF-25=$P<0.05$) and peak inspiratory flow (PIF=$P<0.05$) was to be found in study case group as compared to that of control group (Table II).

Table I: Demographic features of control (general policemen) group and study case (traffic policemen) group.

Parameters	Control Group (General Policemen Group) (n=50)	Traffic Policemen Group (Study Case) (n=50)
Age (years)	36.5±0.89	37.82±1.14
Height (cm)	156.4±0.58	152.5±0.72
Weight (kg)	62.8±1.22	64.85±1.04
Body Mass Index (BMI) (Kg/m^2)	22.28±0.44	23.48±0.36

Values are in Mean ±S.E.

Table II: Comparison of Pulmonary Function Test (PFT) between non-smokers control (General Policemen) group (n=25) and non-smokers of study case (Traffic Policemen) group (n=25).

Sr. No.	Parameters	Non-smokers of control (General Policemen) Group (n=25)	Non-smokers of study case (Traffic Policemen) Group (n=25)
1	**Vehicle Control (VC)**	4.86±0.15	4.54±0.12*
2	**FEV_1**	4.68±0.2	3.97±0.11**
3	**FEV_1/VC**	96.18±3.63	86.30±3.11
4	**PEF**	526.83±24.88	483.56±26.81
5	**FEF-25**	7.76±0.46	6.04±0.68*
6	**FEF-50**	5.74±0.34	5.62±0.42
7	**FEF-75**	3.42±0.32	3.73±0.38
8	**MVV**	154.43±9.64	130.58±7.45
9	**PIF**	328.6±21.76	192.4±15.29*
10	**TV**	0.68±0.06	0.72±0.06
11	**PEF25-75**	4.28±0.29	3.88±0.36
12	**FIF50**	3.66±0.34	2.78±0.24*

Values are in Mean ± S.E., *P<0.05, **P<0.01

Table III: Comparison of Pulmonary Function Test (PFT) parameters between smokers of control (General Policemen) group and smokers of study case (Traffic Policemen) group.

	Parameters	Smokers of control (General Policemen) Group (n=25)	Smokers of study case (Traffic Policemen) Group (n=25)
1	**Vehicle Control (VC)**	4.76±0.14	4.26±0.11*
2	**FEV_1**	3.94±0.10	3.45±0.09****
3	**FEV_1/VC**	88.65±2.36	78.62±2.42
4	**PEF**	522.09±22.45	372.51±15.78****
5	**FEF-25**	7.48±0.27	5.28±0.23****
6	**FEF-50**	6.33±0.21	4.52±0.22****
7	**FEF-75**	4.02±0.20	3.32±0.20*
8	**MVV**	142.60±4.48	87.4±4.69****
9	**PIF**	311.50±19.21	238.6±14.33**
10	**TV**	0.76±0.08	0.83±0.12
11	**FEF25-75**	4.68±0.22	3.25±0.26****
12	**FIF50**	3.52±0.42	2.08±0.24**

Values are in Mean ± S.E., *P<0.05, **P<0.01, ****P<0.0001

In the same way, there was also significant decrease in vital capacity (VC=P<0.05), forced expiratory volume in one second (FEV_1=P<0.0001), peak expiratory flow (PEF=P<0.0001), maximum voluntary ventilation (MVV=P<0.0001), forced expiratory flow at 25% of volume as a percentage of vital capacity (FEF 25%=P<0.0001), forced expiratory flow at 50% of volume as a percentage of vital capacity (FEF50%=P<0.0001), forced expiratory flow at 75% of volume as a percentage of vital capacity (FEF 75%=P<0.05), forced expiratory flow at 25-75% of volume as a percentage of VC (FEF25-75%=P<0.0001), forced inspiratory flow at 50% of inhaled volume (FIF50=P<0.01) and peak inspiratory flow (PIF=P<0.01) in study case group of smokers of traffic policemen as compared to that of control group of general policemen (Table III).

DISCUSSION

The assessment about the ventilation function of the lung such as the tidal volume (TV) recorded give an idea about the requirement of normal oxygen during rest, PEF (peak expiratory flow), FVC/FEV_1 type of disorders and so on were done with the computerized spirometers used by most of the

hospitals and in research laboratories (Virani *et al.,* 2001). Different studies have been carried out in Pakistan as well as outside of the Pakistan to evaluate the different effects of pollution on the different types of the respiratory parameters. But no study was done in Multan to show the different types of effects of air traffic pollution to evaluate the respiratory health of traffic policemen at various chowks. In the present study pulmonary function test (PFT) parameters were also compared in non-smokers and smokers of both groups. This study showed that vehicle control (VC) and maximum voluntary ventilation (MVV) were found to be reduced in traffic policemen group. This study is also related to the study of Pravati *et al.* (2010) in which they also found the same results which showed that MVV and VC are reduced in traffic policemen group and this is due to the presence of some degree of restriction and are limited to the lung expand and due to chronic irritation by pollutants, these changes might be in the tissue of the lungs.

In the present study, PEF during expiration is the maximum rate flow while FEV_1 which is the amount of air expired about in one minute, while in non-smokers traffic policemen group PEF and FEV_1 were found to be less which indicated that during expiration there was some obstruction. No significant was to be found in the traffic policemen group in FEV_1/VC. This indicated decreased vital capacity. FEF25% and FEF25-75% are reduced in the traffic policemen group which showed that during respiration the air ways in general are narrowed which prevent the free air flow.

During inspiration, the condition of inspiratory muscles and the air ways status, FIF50% and PIF were found to be reduced in the traffic policemen group. TV (tidal volume) was found to be higher in traffic policemen group during this study. Similar findings were found to be Ogunsola *et al.* (1994), Evans *et al.* (1988), Karita *et al.* (2001), Chabbra *et al.* (2001) and Pravati *et al.* (2010) and other. But no consistent difference was found to be Nakai *et al.* (1999) in relation to these findings. Except the tidal volume (TV) similar decrease in all the values was to be found in both smoker groups of the traffic policemen and general policemen.

The greater decrease was to be found in parameters like FEF25%, MVV, FEF50%, FEF75%, FEV_1, FIF50%, PEP and FVC as compared to the non-smoker group. This indicated that the lung functions (LF) decrease more the traffic air pollution that is detrimental factor to respiratory health when combines with another type of detrimental factor such as chronic smoking. These findings are also related to the findings by Pravati *et al.* (2010).

Conclusion

On the basis of these findings it is concluded that the long term exposure to gases, fumes and chemicals which are present in the environment near heavy traffic are harmful and dangerous for the lungs. These decreases the lung functions that results in changes in PFT (pulmonary function test) parameters. So, it was suggested that during the duty hours in busy traffic areas, the traffic policemen should use masks and to identify respiratory system if any, they should undergo regular health checkups and follow suitable measurements. Regarding the harmful effects of traffic air pollution, awareness should be created in the public and when the signal time is more is advised to switch off the engine of motorcycles, cars, etc.

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