

Relationship between FVC, FEV₁, FEV₁/FVC% and serum lead level of the traffic policemen in Dhaka city.

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Abstract

Background: Air pollution is increasing day by day in Dhaka city due to automobile exhaust emitted from huge number of vehicles. Automobile pollutants inhalation would increase the blood lead level which may be associated with acute and chronic respiratory disease. **Objective:** To observe the relationship of FVC, FEV₁, FEV₁/FVC% with serum lead level in traffic policemen in Dhaka city. **Methods:** This cross sectional study was conducted in the Department of Physiology, Dhaka Medical College (DMC), Dhaka from July 2014 to June 2015. The study group enrolled 50 apparently healthy traffic policemen aged 25 to 45 years engaged in traffic control at different traffic junctions of Dhaka city and the control group consisted of apparently healthy subjects working in bank and different offices in Dhaka city with similar BMI and age to traffic police subjects. FVC, FEV₁ and FEV₁/FVC% of all the subjects were measured by digital spirometer and serum lead level was estimated by Flame Atomic Absorption Spectrophotometry. Statistical analysis was done by Pearson's correlation coefficient test. Independent sample 't' test. **Results:** In this study, serum lead level was found significantly higher in the traffic policemen than the control group. FVC, FEV₁ and FEV₁/FVC showed negative correlation with serum Lead level but it was not statistically significant. **Conclusion:** From the result of this study, it can be concluded that traffic policemen may be in greater exposure to severe air pollution with higher lead content in Dhaka city and it may affect their lung function.

Key words: Air pollution, FVC, FEV₁, FEV₁/FVC%, serum lead.

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Introduction

Air pollution is a major public health problem. Pollutants of major public health concern include the particulate matter (like Cu, Lead, Mn, Zn etc), carbon monoxide (CO), ozone (O₃), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂). These may cause fatal respiratory and other diseases¹. Lead (Pb) occurs naturally in the environment but the increased concentration of it in the air comes from the motor engines where it is mixed with gasoline².

In the Western Pacific and South East Asian regions, the death toll are 16,70000 and 9,36000

respectively that is 88% deaths occur due to air pollution³. The toxic chemicals (eg; Lead, sulphur, benzene and black carbon) and gases (e.g.; CO₂, CO, NO₂, NO) emitted by motor vehicles cause significant health hazards to the occupations exposed to air pollution for long a time like policemen engaged in traffic control, drivers and street hawkers⁴.

Lead (Pb) is a metal that is very harmful for the human health. It can enter the human body with food (65%), water (20%) and air (15%)³. The acceptable blood Pb level for children is <5µgm/dl and for adult <10µgm/dl⁵⁻⁶.

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Several studies demonstrate the vulnerability of air pollution and pollutants including lead with serious illnesses which include asthma, chronic obstructive pulmonary disease (COPD), cardiovascular diseases, diabetes and lung cancer⁷⁻⁸. Literature reported significant association of reduced lung function with significant increment of serum lead in traffic policemen⁷. Some researcher also found negative correlation between serum lead and pulmonary function parameters⁹⁻¹¹.

Studies investigating the effect of vehicular exhaust on lung function of traffic police personnel have reported conflicting results¹².

So, this study has been designed to observe the relationship between pulmonary function and serum lead level of traffic policemen in Dhaka city.

Methods

This cross sectional study was conducted in the Department of Physiology in Dhaka Medical College from July 2014 to June 2015. Protocol of this study was approved by Ethical review committee of Dhaka Medical College. For this study 50 traffic policemen (TP), aged 25-45 years, working in Dhaka more than 5 years were selected from different traffic junctions of Dhaka city. Fifty age and BMI matched apparently healthy adult male subjects from different offices of Dhaka city were selected as control. All the subjects were free from smoking, tobacco consumption asthma, COPD, diabetes mellitus, hypertension etc. After selection, the nature, purpose and benefits of the study were explained to each of the subjects in details. Informed written consent was taken from the participants. Detailed family and medical history were taken. Anthropometric measurement of the subjects was taken and blood pressure was measured. All the information was recorded in a prefixed data schedule. Pulmonary function test was done by computerized spirometer in Department of Physiology of Dhaka Medical College, Dhaka and serum lead level was estimated by Atomic Absorption Spectrophotometry in the Biochemistry division of Atomic Energy Centre, Dhaka. Data analysis was done by using a computer based statistical

program SPSS (Statistical package for social science) version 21 & Excel. Statistical analysis was done by independent sample 't' test and correlation analysis was done by Pearson's correlation co-efficient test as applicable. P value <0.05 was accepted as level of significance.

Results

General characteristics are presented in the Table I. Mean serum lead level was significantly ($p < 0.001$) higher in traffic policemen than the control (Figure 1). In this study, percentage of predicted value of FVC, FEV₁ and FEV₁/FVC% were found negatively correlated with serum lead level in traffic policemen (Figure 2, 3, 4) but it was not statistically significant.

Table I: General Characteristics of study subjects (n=100)

Parameters	Control (n = 50)	TP (n = 50)
Age (years)	36.66±0.66	36.66±0.66
BMI (kg/m ²)	24.98±0.23	26.02±0.03
SBP (mmHg)	120.00±1.83	20.16±1.44
DBP (mmHg)	76.52±0.94	70.80±1.06

Data shown as Mean ±SE, Statistical analysis was done by independent sample 't' test.

Control = Healthy adult subjects, TP = Traffic policemen. BMI= Body mass index, SBP= Systolic blood pressure, DBP= Diastolic blood pressure.

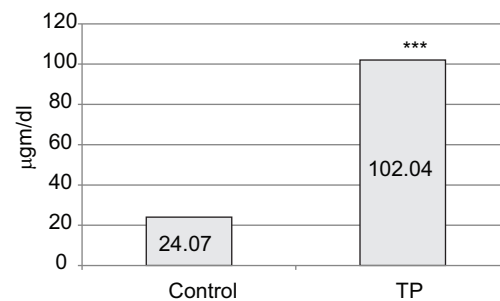


Figure 1: Serum lead level in traffic policemen presenting that the study subjects had high serum lead level than the control. Acceptable blood lead level is <10mcg/dl. (***)= $p < 0.001$)

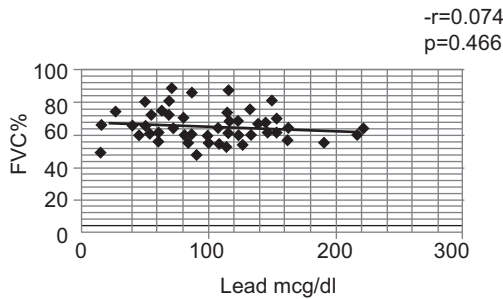


Figure 2: Correlation of serum lead with FVC in traffic policemen presenting that there is negative correlation between serum lead and FVC.

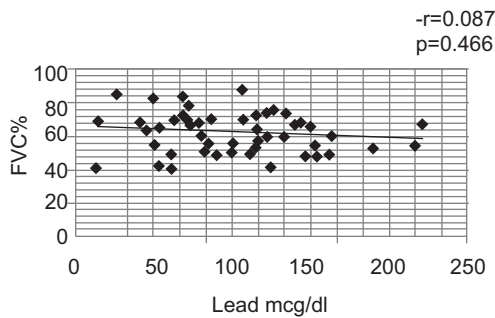


Figure 3: Correlation of serum lead with FEV₁/FVC in traffic policemen presenting that there is negative correlation between serum lead and FEV₁/FVC.

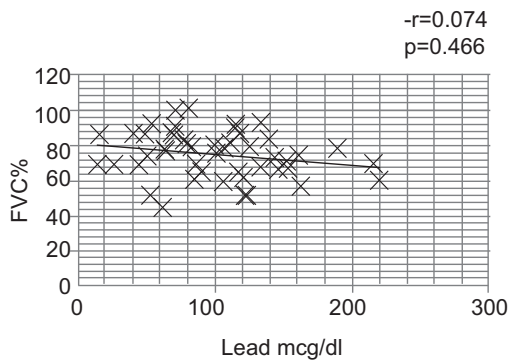


Figure 4: Correlation of serum lead with FEV₁/FVC% in traffic policemen presenting that there is negative correlation between serum lead and FEV₁/FVC%.

Discussion

In this study serum lead (Pb) level was higher in the traffic policemen than the control. Evidence from previous studies also supports this observation¹³⁻¹⁵. But some studies do not support this¹⁶. The correlation analysis in this study between FEV₁, FVC, FEV₁/FVC ratio and serum lead level in TP showed negative relationship though statistically was not significant. But these observations may suggest association of deterioration of lung function with higher lead content in the air to which the TP were exposed to most of their working period. It is not clear how lead exactly cause impaired lung function but literature review suggests that lead passes through the Ca⁺⁺ channel into the cell and binds with calmodulin and causes excessive smooth muscle contraction and thereby bronchospasm¹⁷. Lead also induces bronchoconstriction by decreasing release of nitric oxide (NO) from airway epithelium which is an important endogenous bronchodilator¹⁶. Several investigators of different countries have suggested that decrement of pulmonary function is associated with traffic pollution^{13, 18}. The results of this study suggest that the traffic police had increased serum lead level and decreased lung function.

In the present study, the result suggest progressive deterioration of the lung function in the traffic policemen of Dhaka city was related to the higher lead (Pb) content of its environmental air.

Conclusion

From this study, it may be concluded that increased blood lead level may cause harmful effect on lung function of the traffic policemen in Dhaka city who are exposed to air pollution for prolonged period.

Conflict of interest None

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