Original Research Article

Lung Function Capacity among Traffic Police in Dhaka City

ABSTRACT

Introduction: Air pollution from car exhaust has a negative impact on health. People who are constantly exposed to this car pollution can develop various health problems including respiratory diseases.

Objective: To assess the extent of respiratory failure among traffic police officers in Dhaka.

Materials and Methods: A cross-sectional study was conducted to determine the spirometric parameters of a group of 157 traffic police officers between the ages of 25 and 55 years old serving in the city of Dhaka. Lung function was measured with a portable stationary spirometer. Data were collected using the American Thoracic Society Department of Lung Disease Questionnaire (ATS-DLD-78A). Statistical analysis was performed using IBM's SPSS software. , Study location and period: The study was conducted from January 1, 2018, to December 31, 2018, in the city of Dhaka.

Results: The mean age was 40.94 ± 9.30 years. The FEV1/FVC ratio showed that over 50% of the respondent's lung function parameters were 70% and above. FEV1 and FVC were significantly lower in smokers (2.60 ± 0.71, 3.88 ± 0).76) compared to non-smokers (3.50 ± 0.83, 4.70 ± 0.56). Binary logistic regression analysis showed that age over 20 years (OR 6.87; 95% CI) and smoking (OR 13.62; 95% CI) were independently associated with traffic police respiratory symptoms. Conclusion: The adverse effects of air pollution from direct vehicle exhaust can have a significant impact on these lung dysfunctions.

Key Words: respiratory diseases, traffic police, lung function, air pollution

Introduction

The functional capacity of the lungs of a person consists of various parameters, for example, FVC and FEV1, which are influenced by various pollutants in the air [1]. In modern times, there are harmful effects on the respiratory system due to air pollution [2] Air pollution from road transport is a potential health hazard worldwide and vehicle emissions are causing an urban air quality crisis [3]. Road traffic produces volatile organic compounds, particles, sulfur oxides, nitrogen oxides, and carbon monoxide, which have a negative impact on the health of the exposed population.

Chronic respiratory diseases are affecting more and more people around the world. According to WHO estimates, 235 million people worldwide suffer from asthma and 64 million from COPD [4]. Numerous studies have shown that some people are more exposed to air pollution than others because of their jobs [5]. Traffic cops are exposed to large amounts of air pollution when traveling for long periods on busy roads, stuck in traffic, or standing at bus stops. Studies have also shown decreased lung function in traffic cops who are heavily exposed to traffic-related air pollution [5, 6, 7].

The frequency of obstructive, restrictive, and mixed functional pulmonary diseases has been found to be directly related to dust concentration and exposure time [8]. Long-term exposure to dust can lead to chronic bronchial problems [9]. Studies of the effects of exposure to vehicle pollutants on the respiratory tract are needed to predict the risk factors that may trigger an asthmatic response [10, 11, 12]. Several scientific studies have confirmed the influence of air pollutants on human respiratory functions. This study shows an association between exposure to car exhaust fumes and lung function. Studies have shown a reversible decrease in lung function in populations exposed to road pollution [13]. Continuous inhalation of car exhaust fumes can lead to lower respiratory symptoms such as coughing, shortness of breath, and pain on inhalation [14].

Profession is the most important factor affecting health, traffic police personnel are exposed to many occupational hazards. They are constantly exposed to vehicle exhaust and work in a noisy and polluted environment. In general, working outdoors is dangerous because you are exposed to high concentrations of vehicle pollutants over long periods of time, which increases the risk of respiratory diseases. Traffic police officers are the most exposed to the negative health effects of air pollution compared to 98% of the general population. Professional studies on traffic police personnel help us to understand the effects of vehicle pollution and its specific negative effects and to be able to measure defined exposures [15].

Another very important advantage of the traffic police vehicle contamination test is that it allows a quantitative assessment of the exposure and brings specificity to the risk characterization of the result. This study aimed to measure the volume and lung capacity of traffic police officers deployed at various intersections in the city of Dhaka to determine whether long-term exposure to car exhaust fumes has a deleterious effect on their lung function. In this study, we tried to establish the relationship between the exposure time to car exhaust and the decrease in various lung parameters of traffic police personnel.

Material and Method

It was a cross-sectional study. The study was conducted on 157 traffic police officers from different traffic police stations in and around the city of Dhaka, aged between 25 and 55, using a portable desktop spirometer. The survey was conducted from January 1, 2018, to December 31, 2018, in the city of Dhaka. The respiratory symptoms questions were inspired by the American Thoracic Society Department of Lung Disease Questionnaire (ATS-DLD-78). Data were collected through face-to-face interviews using pre-tested, semi-structured, self-administered questionnaires. Sampling was carried out using a practical sampling technique. Written informed consent was obtained from the participants. A detailed family and medical history was collected. Traffic officers who had been on duty for at least 2 years and had no previous history of lung disease were selected for the study. Data analysis was performed with IBM software. Descriptive statistics included frequency, percentage; Mean and standard deviation were determined. Inferential statistics were performed using one-way ANOVA, a t-test, and binary logistic regression analysis. Ethical approval was obtained from NIPSOM's Institutional Review Board (IRB).

Results

Table 1: Socio-Demographic Characteristics of the Respondents

Characteristics		Frequency	Percentage
Age Group	<30	17	10.8
	30-35	43	27.4
	36-42	27	17.2
	43-48	28	17.8
	49-54	42	26.16
Educational qualification	SSC	26	17
	HSC	48	31
	Bachelor	21	14
	Masters	62	39
Gender	Male	152	96.81
	Female	5	3.18
Marital status	Unmarried	5	3.2
	Married	152	96.8
Religion	Islam	145	92.4
	Hindu	12	7.6

The mean age among the 157 respondents was 40.94 ± 9.30 years. All participants had a range of reading and writing skills, with 39% holding a master's degree. Most respondents were men (96).81% and 96.8% (n=152) of the respondents were married. 92.4% were Muslim and the rest of the respondents were non-Muslim (7.6%) [Table: 01].

Table 2: Smoking habit of the respondents

Characteristics		Frequency	Percentage
Smoking (Recent Time)	Yes	87	55.4
	No	38	24.2
	Does Not Apply	32	20.4
Smoking Habit (in last one month)	Smoked	87	55.4
	Didn't Smoked	38	44.6
Smoking History	Smoker	95	60
	Non Smoker	63	40

Almost two-thirds of 55% (n=87) of the respondents smoked cigarettes and 24% (n=38) of them had negative attitudes towards smoking. Over 50% (n=87) of respondents had smoked cigarettes a month ago (the last time) and a quarter of respondents said they had not smoked, i.e. 24% (n=38). Of the total study population, 60% (n=95) smoked cigarettes and 40% (n=63) refused to smoke or were ex-smokers [Table: 02].

Table 3: Occupational status of the respondents

Characteristics		Frequency	Percentage
Presence of Dust	Yes	149	94.9
	No	8	5.1
Presence of gas and fumes	Yes	145	92.4
	No	8	5.1
	Does Not apply	4	2.5

94.9% (n=149) of respondents felt their workplace was dusty, while only 5.1% (n=8) felt their workplace was not dusty. 92.9% (n=145) of those surveyed believe that gases or chemical vapors are generated at their workplace, while only 5.1% (n=8) believe that such gases do not occur at their workplace [table: 03].

Table 4: Respiratory Symptoms among the respondents

Symptoms		Frequency	Percentage
Wheeze with cold	Yes	106	67.5
	No	51	32.5
Usual Cough		87	55.4
Bringing up phlegm while cough		90	57.3
Wheeze while breathing		106	67.5
Breathlessness while in hurry or climbing		70	44.6
Usual Chest illness		81	51.6

*Multiple responses

Approximately 67% (n=106) of respondents experienced both a cold and wheezing during their shift. 32% (n=51) of those surveyed said they did not hear any wheezing or noise. 52% experienced multiple breathing problems during their time on the road. Among those questioned with current respiratory problems, they complained that the respiratory problems were increasing every day, although most of them did not know the actual causes. On the various symptoms of current respiratory problems 55.4% of respondents had a cough, 57.3% coughed up phlegm or phlegm when coughing, 44.5 % shortness of breath when walking on an airplane or on a slight hill, 67.5 % wheezing from the chest when breathing. Also 51.6% of them stated that they suffered from a lung disease [Table: 04].

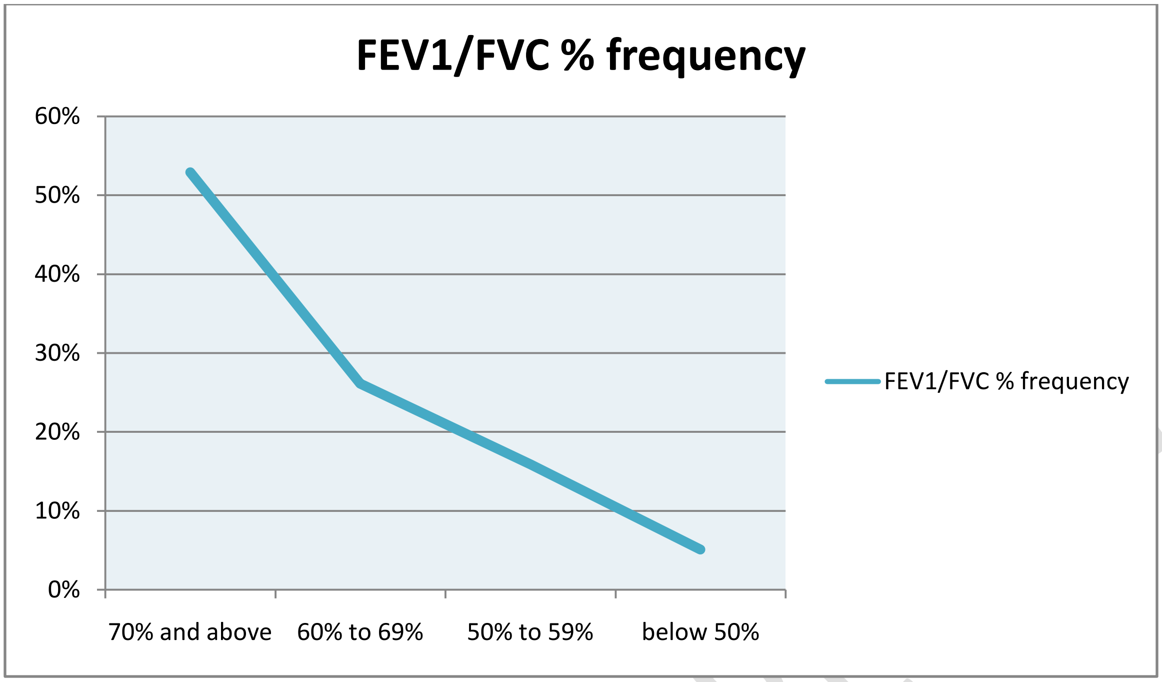

Figure 1: Spirometric value of respondents

The distribution of the FEV1/FVC ratio showed that more than 50% of the respondents had lung function parameters of 70% or more. Subsequently, various types of shortages occurred among the rest of the population, showing the consequences. Less than 50%, indicating significant respiratory problems [Fig. 1].

Table 5: Distribution of spirometric parameters according to findings

Statistic	**FEV1 in Litre**	**FVC in Litre**
Mean(SD)	2.96±0.89	4.20±0.79
Minimum	1.03	2.34
Maximum	4.50	5.67

After evaluating the results of the spirometry data in Table 5, the mean FEV1 was 2.96 ± 0.89 and ranged from a minimum of 1.03 L to a maximum of 4.50 L. The mean FVC was also 4.20 ± 0.79 and varied between a minimum of 2.34 L and a maximum of 5.67 L [Tab. 05].

Table 6: Distribution of lung function parameters among respondents

		Frequency (n)	FEV_1 in Litre	FVC in Litre

Smoking Habit	Non-Smoker	62	3.50±0.83	4.70±0.56
	Smoker	95	2.60±0.71	3.88±0.76
P value			**0.030**	**0.685**
Duration of employment	< 10 years	22	4.07±0.39	5.14±0.35
	10to 20 years	67	3.36±0.61	4.49±0.54
	>20 years	68	2.20±0.56	3.62±0.66
P value			**.098**	**0.708**

Independent two-dimensional t-test analysis showed that various lung function parameters, such as FEV1 and FVC, were significantly lower in smokers (2.60 ± 0.71, 3.88 ± 0.76) compared to non-smokers (3.50±0, 83, 4, 70±0, 56) [Table: 06].

Table 7: Lungs Function of the Respondents

		Frequency	Percentage
Lung function	Normal	52.9	83
	Obstructive	42.0	66
	Combined	5.1	8

52.9% (n=83) of the participants had normal lung function. Of these, 42.0% (n=66) of the respondents indicated a problem with pulmonary obstruction. Only 5.1% (n=8) of participants had mixed Type of lung problems [Table: 07].

Table 8: Results of regression analyses showing independent predictors of respiratory problems.

Dependent variables	**Independent variables**	**Odds Ratio in 95% CI**	**p value**
Cough	Smoking	13.28	.001
	More than 20 years employment	6.87	.004
	Age	7.87	.006
Phlegm	Smoking	16.12	.001
	10 to 20 years of employment	12.50	.018
	Age	0.927	.000
Wheeze	Smoking	5.57	.056
	10 to 20 years of employment	15.86	.004
Breathlessness	Smoking	4.03	.002
	More than 20 years of employment	6.5	.048

Binary logistic regression analysis showed that age over 20 years (OR 6.87; 95% CI) and smoking (OR 13.62; 95% CI) were independently associated with traffic police respiratory symptoms. Separate logistic regression analyses also showed that smoking was also associated with cough, phlegm, wheezing, and shortness of breath, and that time to work was independently associated with other lung diseases, cough, and shortness of breath when walking by plane or on a slight incline [Table: 08].

Discussion

In this study, none of the respondents had previously lived in a dusty area with any motor vehicles. Almost all were from rural Bangladesh. Unlike the city of Dhaka, rural areas of Bangladesh are free from air pollution. Their working hours ranged from 9 hours to a day, and the traffic controller's schedule required them to perform additional duties related to VIP protocols. Traffic cops rarely wore masks during our service. In the present study, almost half of the 47.1% (n=74) selected traffic cops in Dhaka had impaired lung function, with a significant proportion of them suffering from obstructive pulmonary failure. Impaired lung function was more common among civil servants with more than 20 years of service.

Almost all respondents had no history of exposure to a dusty or chemically fired area. The difference between the reported respiratory symptoms in the current year and in previous years is also likely to be due to the duration of exposure and their age. Of those officers with current respiratory symptoms, around 70% complained of a gradual increase in respiratory symptoms and a third said their well-being improved during their weekly holiday. It is likely that respondents were not exposed to harmful car fumes at weekends, making them healthier during those times. The traffic police presented his current respiratory complaints as various combinations of characters. Exposure to engine exhaust, particularly PM (particulate matter), is associated with irritation of the nasal mucosa and other respiratory problems [16, 17].

Cough and mucus secretion are also shown to be coordinated neural reflexes that protect the airways from noxious exogenous agents such as engine exhaust, resulting in a chronic state of stress with hypersecretion, chronic cough and shortness of breath [18]. A spirometric study showed that nearly half of the 52% (n=83) of traffic officers had markedly normal lung function, 42% (n=66) had features of pulmonary obstruction, and 5% (n=8) impaired lung function had characteristics, but there were no limiting devaluations. A similar result was obtained by Satpathy et al., India, where 66.6% of traffic cops examined reduced capacity. Because restrictive variants are common in diseases such as fibrosis, and silicosis, and in older age groups, the study design excluded the absence of restrictive impairment to avoid misinterpretation of study results [19].

This deterioration in lung function can be due to exposure to numerous pollutants such as sulfur dioxide, carbon monoxide, nitrous oxide, particulate matter, and ozone. These pollutants put a strain on the lungs and the resulting oxidative stress is believed to contribute to fibrous lung disease, chronic bronchitis, emphysema, and lung cancer. Chemical substances and toxic gases emitted from vehicles cause irritation and allergies in the lungs and airways of people who are exposed to them for a long time [20], like the subjects of our study, police officers and traffic policeman, Automobile exhaust, especially organic extracts from diesel exhaust, induce reactive oxygen species in macrophages and bronchial epithelial cells, which are the most important target cell type for particulate matter in the lungs [21].

Reactive oxygen species, in turn, activate cytokine and chemokine promoters, leading to allergic inflammation via activator protein 1 and nuclear factor kappa B signaling pathways. Apoptosis and necrosis of bronchial epithelial cells [22, 23]. Diesel exhaust particles, thought to be composed of a carbon nucleus, are surrounded by trace metals such as nickel and salts that adsorb organic hydrocarbons, and many of these components have inflammatory effects in the lungs that have been observed in laboratory animals. Inhaling hydrocarbons also causes pneumonia. These observations suggest that diesel particulate matter can itself cause airway inflammation.[24, 25].

We also observed that the true value of forced vital capacity (FVC) of 2.96 ± 0.89 and forced expiratory volume in 1 second (FEV1) of 4.20 ± 0.79 for the circulatory means are lower than expected values. Compared to other studies such as Ingle et al. In India, Jalgaon was found to have an FVC of 3.03L and an FEV1 of 2.27L, which is much lower than expected. Another study by Wongsurakiat et al. in Thailand showed that the traffic police indicated a reduced volume of FVC and FEV1 to 3.29 ± 0.5L and 3.86±0.5L. Similarly, Sharad G et al. in Nepal a significant decrease in FVC (2.7 l) and FEV1 (18L). This shows some airway limitations on the part of traffic police personnel. Lung tissue can be damaged by chronic irritation from pollutants. FEV1 was lower in traffic cops, suggesting disability was present during the run. In addition, FEV1 varied by at least 1.03 to a maximum of 4.50 and FVC from 2.34 to 5.67.

In people with airway obstruction, rapid exhalation leads to premature closure of the airways due to the increase in intrathoracic pressure generated during the procedure. The phenomenon of "trapped air" arises from dynamic compression caused by increased airway resistance in the thoracic cavity and loss of elastic recoil is caused. Therefore, the FEV decreases [19]. Airflow restriction is caused by diseases such as asthma, chronic bronchitis, emphysema, and exposure to automobile exhaust. In some cases, however, FEV1 and FVC decrease, so restrictive and obstructive features are also present [11]. The results of these studies confirm this physiological mechanism. The condition of impaired lung function occurred more frequently in people over 42 years of age. Respondents with more than 20 years of work experience (37.5%) belong to the same group. Age-related changes in the respiratory system also contribute to the discrepancy between actual and predicted values. The strength of the respiratory muscles decreases with age, the chest wall becomes stiffer with less compliance, cilia, and macrophage activity decrease, the mucosa becomes drier, the cough reflex decreases, and the response to hypoxia and hypercapnia decreases [26].

Our study included middle-aged individuals in both groups, so age-related changes are to be expected, which partly explains the significant difference between actual and predicted values. As for smoking, 60% of police officers were smokers. Most parameters include FEV1 or FVC 2.60 ± 0.71.3.88 ± 0.76 and overall respiratory failure was significantly lower in smoking police officers ($p < 0.05$). In a similar study conducted by Mahfuz among transport workers in the city of Dhaka, M et al. also show a significant decrease in FVC (3.88 ± 0).48) and FEV1 (2.44 ± 0.71) for smokers. Smoking is known to contribute to obstructive changes that cause irritation of the airway mucosa, leading to the proliferation of mucosal epithelial cells. This leads to increased mucus secretion and leads to the formation of mucus plugs; These mucus plugs impede the outflow of inhaled air, leading to the development of obstructive features [27]. Previous studies have also observed that smoking is associated with an additional risk of obstructive pulmonary disease in vulnerable groups [28].

There was a significant reduction in FEV1 and FEV1/FVC ratios depending on age. A significant association was found between seniority and FVC. Traffic cops exposed to automobile exhaust for more than 20 years of service had FVC (3.62 ± 0.66) and FEV1 (2).20±0.56). Over the 10 to 20-year period, services showed FVC (4.49 ± 0.54) and FEV1 (336±0.61). It should be noted that the reduction in FVC in restrictive pulmonary disease and pulmonary dysfunction after exposure to automobile exhaust is generally obstructive [18].

A recent cross-sectional study has shown that age, gender, smoking and socioeconomic status are independent risk factors for chronic obstructive pulmonary disease (COPD) in Dhaka residents [29]. Although this study was conducted with the general population of all ages, not high-risk individuals such as traffic police.

The regression analysis for the odd ratio shows that there is an increased risk in the workplace for transport workers exposed to air pollution. The odd factor for the symptoms examined (simple cough, shortness of breath, and lung disease) was >1. The odd ratio values for common cough, shortness of breath, and lung disease are 13.28, 6.50, and 15, respectively.86 or 95% of the class level. These results clearly demonstrate the importance of symptom prevalence in traffic cops. These data indicate a significant association between excessive risk of respiratory disease among transport workers and exposure to urban traffic pollution. Other studies show a similar regression result, for example, Tamura et al. in Bangkok showed that the relative OR for common cough or phlegm symptoms among police officers was 2.19 with 95% CI 1.47-3.26. Shard G et al. from Patiala, India showed an OR of 6,37,2 for frequent cough, shortness of breath, and airway irritation.06 or 3.18. Similarly, Ingle et al. in Jalgaon, India, the odds ratios for symptoms of frequent cough, shortness of breath, and airway irritation studied for frequent cough, shortness of breath, and airway disease were 2.96, 1.22, and 7.5 each at 95% of the grade area level. A lung function test is one of the methods for determining the state of the human respiratory system. An independent t-test was used for lung function testing of the test group.

Conclusion

The study found a higher incidence of chronic respiratory disease and decreased lung function in traffic police. The worsening of their respiratory illnesses was related to the work environment. These findings could serve as an advocacy tool for legislation that could reduce emissions of harmful air pollutants from vehicles. According to this study, traffic police officers are at high risk of shortness of breath due to car exhaust emissions in their work environment.

Statement of Ethics

Ethical approval was obtained from IRB NIPSOM.

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