e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(3); 389-394

Original Research Article

Evaluation of Respiratory Morbidities and Pulmonary Functions among Traffic Policemen of Western Gujarat Region

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Received: 25-12-2023 / Revised: 23-01-2024 / Accepted: 26-02-2024

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Conflict of interest: Nil

Abstract:

Background: Urban development and the increasing number of vehicles have led to a significant public health concern in modern Indian cities: air pollution. Considering the demands and environment of their work, traffic policemen may experience respiratory issues such as asthma, chronic obstructive pulmonary disease, rhinitis, recurrent respiratory tract infections, and other related illnesses.

Objectives: Our study aimed to evaluate the lung volumes and capacities of traffic police personnel stationed at different traffic junctions in the Western Gujarat region. Our objective was to explore the possible impacts of extended exposure to vehicle exhaust on lung function. Furthermore, the study aimed to investigate whether there was a correlation between the duration of exposure to vehicle exhaust among traffic police personnel and any potential decrease in lung function.

Materials and Methods: A control group of 250 males, all in good health and of similar age, was included in the study. These individuals were working in different government departments in Gujarat and had not been affected by traffic pollution. Furthermore, there was an additional cohort of 250 individuals who worked as traffic police personnel. A pretested, semi-structured questionnaire was used to gather information on demographic profile, duration of exposure, smoking history, allergy/asthma history, and the use of personal protective measures. A pulmonary function test (PFT) was conducted to evaluate lung function using computerised spirometry.

Results: In the study, a group of 250 traffic policemen were included. Most of the participants, 92% to be exact, were male, leaving only 8% who were female. The average age was 36.22 ± 2.1 years. Most of them had a bachelor's degree. The recorded anthropometric data of traffic police did not show any statistically significant difference. The statistical significance level was found to be less than 0.05. When it comes to traffic policemen and controls, it has been found that traffic policemen tend to have significantly lower values for FVC, FEV1, FEV1/FVC, MVV, and Peak expiratory flow rate (PEFR).The statistical significance level was found to be less than or equal to 0.05.

Conclusion: Spirometry can be a valuable tool for identifying respiratory illnesses in traffic policemen. Being exposed to respiratory pathogens, like air pollution, can make it a useful screening tool for health journalists. Regular medical surveillance, including spirometry, is advised to evaluate pulmonary function and aid in the early detection and treatment of potential issues.

Keywords: Air pollution, Pulmonary Function Test, Spirometry, Traffic Policemen.

Introduction

Pollution in developed countries is primarily a result of various factors, including vehicular traffic, domestic heaters, industrial activities, urban solid waste incineration plants, coal-fired power plants, and nuclear activities. Motor vehicle exhaust emissions play a significant role in urban air pollution. These emissions release a variety of harmful pollutants into the air, including carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO2), sulphur monoxide (SO), sulphur dioxide (SO2), particulate matter, benzene, ozone (O3), and various metals such as lead, cadmium, arsenic, and nickel. [1-4] Urban pollution has a multitude of detrimental effects on human health.

These effects can potentially harm various organs or systems, either in the short term or over an extended duration. [5-7] In recent decades, air pollution has emerged as a significant public health concern in India. Major urban centres like Delhi, Mumbai, Chennai, Bengaluru, and other cities are currently grappling with the severe repercussions of air pollution on the health of their residents. [8]

Air pollution has profound effects on our well-being, leading to respiratory illnesses, cardiovascular conditions, heightened cancer susceptibility, and even untimely mortality. Air pollution is well-known for its harmful impact on the respiratory system. [8] The impact of road traffic on air pollution is a global concern, as vehicle emissions play a significant role in the air quality crisis in urban areas. [9,10] Given the nature of their work, it is clear that traffic police personnel are frequently exposed to significant levels of pollutants while working long shifts on roadways. Exposure to air pollutants from motor vehicles, especially diesel exhaust particles, can lead to symptoms such as coughing, increased sputum production, and reduced lung function. Early detection of pulmonary disease through regular assessment, including spirometry, increases the chances of implementing preventive or corrective measures that can be beneficial. [9] Common symptoms of exposure may include eye and nasal irritation, coughing, headaches, and fatigue. Exposure to certain substances over an extended period can lead to the development of various health conditions, including asthma, chronic obstructive airway disease, and malignancy. [11]

Exposure to pollutants emitted by vehicles can have detrimental effects on individuals' well-being. There are several pollutants that we need to be aware of, such as volatile organic compounds, suspended particulate matter, sulphur oxides, oxides of nitrogen, and carbon monoxide. [12,13] Given the lungs' expansive surface area, delicate respiratory membranes, and significant pulmonary blood flow, they are especially susceptible to damage. Exposure to these pollutants over an extended period can lead to a range of health issues, including heart problems, impaired lung function, respiratory illnesses, lung cancer, and COPD. [14,15] Being exposed to harmful substances in the air we breathe can have negative impacts on our respiratory system. It can result in respiratory diseases, both in the short-term and long-term, along with a decrease in lung function.

Considering the nature of their job and the surroundings they work in, traffic police officers are constantly exposed to the harmful effects of vehicle exhaust emissions. With the help of a computerised spirometer, a pulmonary function test (PFT) can effectively assess lung volumes and flow, enabling the early detection of any potential lung function issues. The study investigated lung volumes and capacities in traffic police personnel stationed at different traffic junctions in the Western Gujarat region. Our goal was to examine the possible impact of prolonged exposure to vehicle emissions on lung function. Our study aimed to examine the potential effects of long-term exposure to vehicle exhaust on the respiratory health of traffic police officers.

Material and Methods

A study took place in the western region of Gujarat over a span of 7 months. The study obtained ethical approval from the institutional ethical committee, and all participants gave written informed consent. The participants were of Indian descent. There were 250 individuals who worked as traffic police personnel, and another group of 250 healthy males of similar age who served in different government departments in Gujarat and were not exposed to traffic pollution. These individuals were used as the control group for comparison purposes.

We recruited traffic police personnel stationed at traffic signals who met specific criteria: aged between 20 and 55 years, with at least 1 year of job experience, and willing to provide written informed consent.

The data on age, duration of service, history of smoking, and use of protective measures was collected using a pretested, semi-structured pro forma. Additionally, the individual had experienced respiratory symptoms in the past and had a family history of allergy and asthma. During the initial screening examination, the healthcare professionals recorded anthropometric measurements such as height and weight. Individuals who were not eligible for the PFT study using a computerised spirometer were those with pulmonary disease, acute infection, lung diseases such as tuberculosis, as well as those with nervous system disorders, seizures disorder, heart disease, and any contraindication for spirometry. A comprehensive survey was carried out, which included interviews with 280 traffic policemen and conducting PFT for 250 individuals.

Computerised spirometry is a reliable and noninvasive technique used to evaluate pulmonary function, specifically the lung's ability to ventilate. The test was performed on a relaxed individual who was seated and received appropriate guidance and demonstration. Participants were given clear instructions on how to use the spirometer, including how to properly position the mouthpiece and create a secure seal with their lips. Participants were instructed to inhale deeply and exhale forcefully into the disposable mouthpiece. The manoeuvre was executed three times, and the highest measurement out of the three was documented. The

computerised spirometer was utilised to measure the following parameters. Exploring the intricacies of the human body kindly provide your height in centimetres without wearing any shoes. Stand with your feet together, maintain an upright posture, and focus your gaze straight ahead. It is important to use a trustworthy measuring device in order to guarantee precision. The individual's weight was measured using a standardised weighing scale and recorded in kilogrammes. The measurements were taken under specific conditions, ensuring accuracy and consistency. The subject was dressed in light clothing, without shoes, and had an empty bladder prior to lunch.

During the clinical examination, it was observed that all the participants were in good physical health, with no indications of any acute respiratory illness. Participants were given ample practice and a minimum of three chances to try.

The recordings were made in the morning, before the police personnel could start their shift. We used a frequency range of 60-80/min for MVV, and the testing duration was set at 15 seconds. We used the Indian Kamat reference values16 to calculate predicted values for comparison with the test results.

Statistical analysis

The data was inputted into a spreadsheet computer programme, specifically Microsoft Excel 2007, and then transferred to the data editor page of SPSS version 15, developed by SPSS Inc. in Chicago, Illinois, USA.

The quantitative variables were reported using either means and standard deviations or median and interquartile range, depending on their distribution. The qualitative variables were displayed as counts and percentages. All tests were conducted with a confidence level of 95% and a level of significance of 5%.

Results

A total of 250 traffic policemen were included in the study. Out of the total, 230 individuals (92%) were male, while 20 individuals (8%) were female. The average age was 36.22 ± 2.1 years. The majority of them held a bachelor's degree. No significant differences were observed in the recorded anthropometric data among traffic police officers. The statistical significance level was found to be less than 0.05.

In a recent study, researchers compared traffic policemen and controls, revealing that traffic policemen exhibit significantly lower values for FVC, FEV1, FEV1/FVC, MVV, and Peak expiratory flow rate (PEFR).The statistical significance level was found to be less than or equal to 0.05.

Table 1: Anthropometric Distribution of study Participants

Variables	Group A (Mean±SD)	Group B (Mean±SD)	P value
Age (Years)	36.10±2.22	36.54±3.19	0.23
Height (cm)	170.25±3.89	169.40±5.29	0.15
Weight (kg)	70.42±2.78	69.48±12.10	0.09
BMI (kg/m^2)	24.09±3.14	24.01±1.35	0.07

Statistically significance at p≤0.05

Table 2: Pulmonary Function Parameters of Both Groups

Variables	Group A (Mean±SD)	Group B (Mean±SD)	P value
FVC (L)	2.59±2.10	3.08±2.58	0.02*
FEV1 (L/Sec)	2.10±0.90	2.54±0.47	0.005*
FEV1/FVC (%)	80.11±2.90	85.12±1.15	0.001*
PEFR (L/Sec)	7.39±0.97	8.48±1.13	0.001*
MVV (L)	130.78±22.10	142.57±23.19	0.002*

* indicate statistically significance at p≤0.05

Discussion

Our study revealed a decline in lung functions among traffic policemen. Even in the control group, this decline can be attributed to the fact that (1) the mean age was matched at 38 years (2) A total of 13 individuals out of 100 were smokers (3). These individuals were selected from office staff personnel who lead a sedentary lifestyle and do not engage in much physical activity. As part of the study, computerised spirometry was used to measure lung volumes and capacities. The aim was to assess the impact of occupational hazards from air pollution on traffic police officers who were already employed. During our investigation, we uncovered occasional deterioration in lung functions. It's crucial to consider that discrepancies between actual and projected values may also stem from age-related changes in the pulmonary system. Several scientific studies have shed light on the potential impact of urban air pollution on respiratory functions, specifically FVC and FEV1.Seventeen and eighteen the study conducted by Van der Lende et al. [19] there is an interesting

connection between respiratory health and residing in close proximity to busy highways, as revealed by a recent study conducted in the Netherlands. There is a worrisome connection that has been discovered between expiratory flow-volume and working in close proximity to a busy highway. Additionally, there seems to be a correlation between FEV1 and the frequency of motor trucks passing by on a daily basis. Recent research [20] findings indicate a notable disparity in spirometric parameters between bus drivers and mechanics who are exposed to specific conditions, compared to a control group. Workers who have been exposed for longer than 10 years tend to experience almost all respiratory symptoms, unlike those who have had shorter exposure. Researchers in India have discovered a concerning link between long-term exposure to urban pollution and a decline in lung function among traffic police officers. It appears that extended exposure to air pollution can have negative impacts on people's respiratory well-being. [21] Researchers recently conducted a study comparing traffic police officers to a control group from the general population. The results revealed that the group exposed to traffic-related pollutants showed a notable decline in respiratory functionality, particularly in FEV1 and FVC, in comparison to the non-exposed group. [18,21]

Air pollution in India is a major issue that greatly affects public health, especially for those living and working in urban areas. The rise in vehicle numbers has had a detrimental impact on air quality. Continuous exposure to air pollutants can have serious health implications for traffic policemen.

Various pollutants, including sulphur dioxide, carbon monoxide, nitric oxide, particulate matter, and ozone, have a significant impact on lung function parameters, leading to a decline in respiratory health. These pollutants have a significant impact on the lungs, leading to oxidative stress and potentially contributing to the development of fibrotic lung diseases, chronic bronchitis, emphysema, and lung cancer. [22] Our research reveals that prolonged exposure to vehicular emissions can lead to irritation and allergies in the lungs and airways of individuals, including traffic policemen. Exposure to vehicular exhaust, especially organic extracts of diesel exhaust, can lead to the production of reactive oxygen species in macrophages and bronchial epithelial cells. These cells are particularly susceptible to the harmful effects of particulate matter in the lungs. [23,24]

Reactive oxygen species trigger the activation of cytokine and chemokine promoters, resulting in the development of allergic inflammation via distinct signalling pathways. Recent research findings suggest that organic diesel exhaust particles can trigger cell death in bronchial epithelial cells through a mitochondrial pathway. [24,25] Diesel exhaust particles consist of a carbon core, as well as trace metals such as nickel and salts that absorb organic hydrocarbons. These components have been linked to inflammatory lung effects in laboratory animals. Inhaling hydrocarbons can lead to lung inflammation. These findings indicate that diesel particles may lead to inflammation in the airways. [26,27] Research has shown that traffic police personnel often experience lower forced vital capacity (FVC) and forced expiratory volume in 1 second (FEV1) when compared to predicted values. Traffic police personnel seem to experience a degree of respiratory tract restriction. Long-term exposure to pollutants can result in alterations in lung tissue. There was a noticeable decrease in the FEV1 measurement among traffic police personnel, indicating potential difficulty in exhaling possibly caused by obstruction.

Studies conducted across India and other countries have consistently shown that traffic policemen tend to have lower PFT parameters compared to other groups. In a recent study conducted at Puducherry and Gujarat, all PFT parameters were found to have decreased, which is consistent with the findings of the present study. It seems that the participants are experiencing a decline in lung function. [11,28] A study conducted by Ingle et al. in Jalgaon city aimed to examine the impact of vehicular pollution on respiratory health.

Based on the study findings, the PFT parameters of traffic policemen were observed to be considerably poorer in comparison to the control group. [29] A study conducted in Puducherry investigated the pulmonary function of traffic policemen and general policemen. Based on the study findings, it was observed that traffic policemen showed a significant decrease in their pulmonary function in comparison to the control group. It seems that air pollution from traffic has a negative impact on the respiratory health of traffic policemen. [12]

The study had a limitation in accurately distinguishing between obstructive and restrictive dysfunction using simple spirometry. Although it is possible to visually interpret the flow volume loop of spirometry to differentiate between the two types of lung diseases, this method is not considered reliable and therefore not utilized.

Conclusion

Using spirometry on traffic policemen can be a valuable way to detect respiratory conditions that may be present. Being exposed to respiratory pathogens, like air pollution, can make it a useful screening tool for health journalists. Regular medical surveillance, including spirometry, is advised to evaluate pulmonary function and aid in the early detection and treatment of potential

issues. Regular health education is essential for understanding the importance of wearing respiratory masks and getting medical examinations. Promoting the use of electrical and hybrid vehicles, implementing regular vehicle emission tests, and encouraging carpooling are effective strategies to combat vehicular pollution.

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