Original Article

Comparison of Pulmonary Function Test in Petrol Pump Worker and Auto-rickshaw Driver

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Abstract

Background: Rapid rise in petrol pump filling station is seen in the last decade, and air pollution had increased drastically. Air pollutants and components in petrol may have delirious effect on respiratory health. Petrol pump workers are exposed to both factors, whereas auto-rickshaw drivers are exposed mainly to air pollutants. In the present study, respiratory function in petrol pump workers was compared with auto-rickshaw driver and healthy controls. **Materials and Methods:** This was the cross-sectional study done on petrol pump workers, auto-rickshaw drivers, and healthy volunteers. ndd Large TrueFlow™ (EasyOne) spirometer was used to assess pulmonary function. One-way ANOVA and Chi-square test were used using statistical software. **Results:** No significant difference was seen in various spirometry parameters studied. Furthermore, no significant difference was observed the pattern of the lung function in three groups. **Conclusions:** Nine years of occupation as petrol pump worker and auto-rickshaw drivers are not having any significant effect on lung function; however, large multicentric trials are recommended, whereby the role of various factors controlling pollution would be studied.

Keywords: *Auto-rickshaw drivers, benzene, particulate matter, petrol pump workers, pulmonary function*

Introduction

Petrol and its derivative are the most important source of energy in the entire world. Rapid increase is seen in automobile number in the last two decades. As a result of which, air pollution had become major concern in all cities. In India, the government had already taken major steps to control air pollution. Air pollutants are the major concern for many health hazards. Respiratory health status gets badly affected as a result of air pollutant. This is demonstrated as a decrement in pulmonary function in the persons who are directly exposed to these, such as bus drivers, mechanics, and policeman.[1-4]

Petrol filling station number had also increased as a result of increased number of automobiles on the road. Staff working here is exposed not only to air pollutant but also to organic and inorganic component present in petrol. Petrol is a complex mixture consisting mainly of hydrocarbons with a range of 3-11 carbon atoms. There is a wide range of volatile aromatic hydrocarbons (VAH) present in the atmosphere of service stations as a result of emission of vapors during dispensing, loading, unloading, and transportation of petrol. The major VAHs are benzene, toluene, and xylene (BTX), often referred to as the BTX compounds.[5]

We had come across various studies in petrol pump workers in India in Aurangabad (Maharashtra), Chittoor (Andhra Pradesh), Delhi, Mysore, and Ahmedabad. Majority of authors found restrictive pattern of the lung pattern, whereas some found mixed pattern. In all the studies, benzene and air pollutant were considered to be mainly responsible agent. This has been supplemented by some studies where it had been showed that in a single refueling operation that lasts for about 1 min, the mean air concentration of benzene to which a petrol pump worker is exposed is 3709 μg/m^3.[6,7] In addition, most of the benzene (88%) is emitted while supplying fuel to the vehicle. Some authors also found poor ambient air quality of that particular region. High levels of suspended particulate matter and respirable suspended

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particulate matter have been shown near the petrol filling station. Further, magnitude of the problem worsened with more duration of exposure.[8-12]

In the present study, we had compared the lung functions in petrol pump workers with auto-rickshaw drivers. We had not encountered any such type of study. Reason for this was that auto-rickshaw drivers are not exposed to petroleum products, but the petrol pump workers are exposed to both factors. Thus, we could have an idea about the main causative agent, whether it is petroleum products or air pollutants.

Bhopal is considered to be one of the greener cities in India. Hence, our focus is also whether this greenery is having any protective effect in petrol pump workers and auto-rickshaw drivers.

The objective of the study was to assess respiratory health status using spirometry in petrol pump worker and auto-rickshaw drivers. Further, we had compared these parameters in both groups with healthy controls.

Materials and Methods

This was the cross-sectional study which was done in AIIMS, Bhopal, on three groups. Participants recruited were in the age group of 23–55 years. Three groups are mentioned in Table 1, three groups were contols, petrol pump workers and auto rickshaw drivers.

All the participants were asked about history of any complaints, occupational, and personal history. A general and systemic examination was done followed by pulmonary function test (PFT) after obtaining the consent. Exclusion criteria for the participants were as follows:

- Smokers
- History of chronic respiratory disease
- History of cardiac disease
- History of diabetes
- History of drug intake known to affect respiratory function
- Examination finding suggestive of preexisting respiratory or cardiac disease
- Chest and abdominal pain for any cause
- Oral or facial pain exacerbated by mouthpiece.

Pulmonary function test

In PFT, ndd Large, TrueFlow™ (EasyOne) spirometer was used. All the participants were made familiar with the instrument and the procedure for performing the test. The data of the participants as regards to name, age, height, weight, sex, date of performing the test, atmospheric temperature, and humidity were fed. Temperature and humidity were measured using digital temperature and humidity meter.

The tests were performed in the sitting position. The participant was asked to take full inspiration which was followed by as much rapid and forceful expiration as possible in the mouthpiece. Three consecutive readings were recorded, and the best reading among the three was selected.

PFT parameters were considered acceptable if they were following within and between the maneuver acceptability criteria. Guidelines given in the joint statements on the lung function testing of the American Thoracic Society and the European Respiratory Society were followed.[13]

PFT parameters studied were forced vital capacity (FVC), forced expiratory volume in 1 s (FEV1), FEV1 as percentage of FVC in % [FEV1 (%)], peak expiratory flow rate in L/s, (PEFR) and forced expiratory flow rate during 25%–75% of expiration (FEF 25%–75%).

Weight was measured with the digital weighing machine to the nearest 5 gm. Height was measured using the scale after the participants stood erect with the feet firmly in contact with platform and looking straight ahead in Frankfurt plane to the nearest millimeter.

Approval from the institutional ethics committee was obtained before the start of the study.

The statistical analysis was done using statistical software. These readings were compared using one-way anova and $P < 0.05$ will be taken as statistically significant. Chi-square test was used to compare the frequency of various patterns.

Results

There were totally three groups in the study. All the participants included in the study were males in the age group of 23–55 years. Anthropometric parameter of the participants is shown in Table 2. All three groups were matched in all anthropometric parameters. No statistical difference was observed between the groups in these parameters.

The lung function parameters in the three groups are shown in Table 3. There was no significant difference in any of the parameters studied in the study. Patterns of the lung function were also studied in all groups. No significant difference was seen in various patterns in the three groups [Chart 1].

Discussion

With this study, we had made an attempt to evaluate the respiratory function in petrol pump workers and

Table 1: Characteristics of the group and inclusion criteria

	Groups	Inclusion criteria
Group 1 (*n*=45)	Control (age- and sex- matched from the staff of medical college)	Nonsmokers Healthy
Group 2 (*n*=41)	Petrol pump workers	Nonsmokers Healthy
Group 3 (*n*=41)	Auto- rickshaw drivers	Nonsmokers Healthy

Table 2: Anthropometric parameters and the duration of exposure

Parameters	Control (*n*=45)	Petrol pump worker (*n*=41)	Auto-rickshaw driver (*n*=41)
Age (years)	32.55±8.31	33.5±10.11	32.01±9.33
Height (cm)	168.21±7.95	164.50±6.57	164.24±10.66
Weight (kg)	62.11±9.42	66.92±11.30	63.48±12.23
BMI (kg/m^2)	22.11±3.69	24.94±4.87	23.51±4.01
Duration of occupation	-	8.94±2.38	9.12±2.11

No significant difference. BMI: Body mass index

Table 3: Lung function parameters of petrol pump workers, auto-rickshaw drivers, and control

Parameters	Control (*n*=45)	Petrol pump worker (*n*=41)	Auto rickshaw driver (*n*=41)
FVC (L)	3.61±0.60	3.68±0.86	3.67±0.88
FEV_1 (L)	2.99±0.55	3.14±0.77	3.11±0.84
FEV_1/FVC	0.86±0.06	0.84±0.09	0.81±0.15
FEF (25%-75%)	3.41±1.21	3.67±1.23	3.59±1.42
PEFR (L/sec)	6.72±1.95	6.71±1.94	7.11±2.38

No significant difference. FVC: Forced vital capacity, FEV_1: Forced expiratory volume in 1 s, FEF: Forced expiratory flow, PEFR: Peak expiratory flow rate

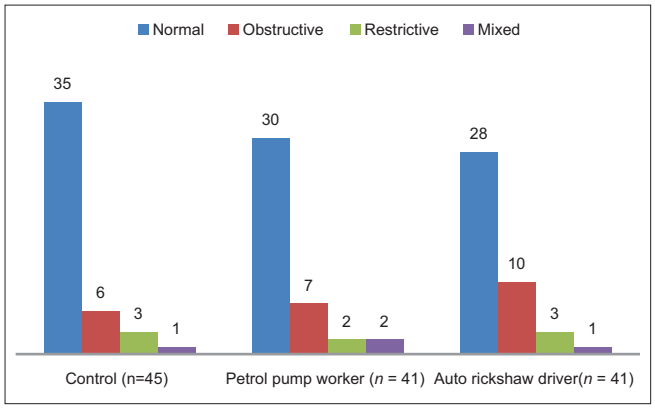

Chart 1: Patterns of lung function in petrol pump workers, auto- rickshaw drivers, and control. No significant difference

auto-rickshaw drivers. Our main aim was to see whether petroleum products are affecting respiratory function. However, we could not get any decrement in respiratory function in both groups in Bhopal. This was one of the unique studies, where petrol pump workers were compared with auto-rickshaw drivers.

We had encountered certain studies in India and Pakistan from various cities such as Aurangabad (Maharashtra), Chitoor (Andhra Pradesh), Delhi, Mysore, Trivandrum, Jammu, Ahmedabad, and Karachi (Pakistan).[8-12,14,15] Results of all these studies were contradictory to that of ours. In all studies, decrement was observed in the lung function. Many authors found a restrictive pattern in the lung function. Furthermore, this was directly related to the duration of exposure. Interestingly, in one of the studies, this pattern changed to mixed pattern with increased duration of exposure.

We also did not get any significant impairment in the lung function of auto-rickshaw drivers. Auto-rickshaw drivers are also exposed to all the factors except petrol vapor. In some studies, in auto rickshaw drivers, restrictive and mixed patterns were seen. In some studies, in traffic police officers, bus drivers, conductors, and taxi drivers, decrement was seen in the lung function.[1,3,4,16,17] However, traffic police officers deputed in the rural population were having completely normal lung function.[4]

Various factors were considered to be responsible for deterioration of the lung function. Main factors responsible were inhalation of petrol vapor and automobile exhaust, which is almost for >8 h a day in petrol pump workers. Benzene in petroleum vapor was considered to be one of the exacerbating factors. Automobile exhaust contains particulate matter and gases such as sulfur dioxide, carbon dioxide, carbon monoxide, and nitrogen dioxide. Chronic exposure of these substances may lead to chronic inflammation of the respiratory tract and lung parenchyma. Furthermore, it is seen that major site of impact of particulate matter is terminal bronchiole.[9-12,18] Gasoline fumes exposure was also shown to produce genotoxic effect.[19] The use of petrol vapor recovery system is also advocated in some countries but not in India.[12]

Auto-rickshaw drivers are mainly exposed to automobile exhaust. Particulate matter <2.5 micron and diesel exhaustive particle of size <0.1 micron have been shown to produce reactive oxygen species.[3,20] They promote CYP1A1 mediated inflammation and also activate transduction pathway which involves mitogen-activated protein kinase and nuclear factor-kappa β.[14,16,21] These are responsible for the release of various cytokines. All these factors may produce decrement in the lung function.

What may be the reason for no significant difference in the lung function in the present study? The reason may be duration of occupation and level of pollution in the city. In many of the studies on petrol pump workers and auto-rickshaw drivers, duration was the main factor. More

decrement in the lung function is seen with increased duration of occupation in both auto-rickshaw drivers and petrol pump workers. Most authors found the lung function impairment with >5 years of occupation.[9,11,12,15] We could not get any significant impairment in spite of 9 years of occupation. This may be due to the level of pollution in the city.

We encountered some studies in Delhi and Mysore region where ambient air quality was monitored.[10,11,22] They found a poor ambient air quality and these data were provided by the central pollution control board. Poor ambient air quality was responsible for the decrement in the lung function. In both these studies, no direct linking was done to any of the factor responsible for poor air quality. However, trees play a major role in controlling air quality. In one of the studies, traffic police officers in the rural region found no deterioration in the lung function. We had also tried to collect data from the Central Pollution Control Board website; we could get data of 2017 and 2018.[23,24] Data of 2017 were coming under satisfactory category, but data of 2018 were coming under moderate category. Moderate category means, it may cause breathing discomfort to people with lung diseases such as asthma and discomfort to people with heart disease, children, and older adults. From 2017 to 2018, air quality of Bhopal had changed. The reason may be many such as decreased plantation, increased automobile number, and industrialization. Hence, the participants in our study had been exposed to poor air for past 1 year. This may be the reason that we could not get significant change in the lung function. Bhopal is considered to be one of the Green cities in India. Greenery here might have prevented the effect of pollution on the pulmonary function. Thus, trees are real wealth on the earth; every effort should be taken to save the trees.

However, one of the limitations of the study was small sample size and daily monitoring air quality data in the petrol pump area over a long duration. Furthermore, air quality data of the auto-rickshaw drivers could not be monitored. We recommend similar studies with multicentric trials, whereby various cities would be compared. Cities need to be divided depending on the population densities and level of industrialization.

Conclusions

Nine years of occupation as petrol pump worker and auto-rickshaw driver are not having a significant effect on the lung function which may be due to lower level of pollution in Bhopal. However, large multicentric trials are recommended, whereby the role of various factors controlling pollution would be studied.

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Conflicts of interest

There are no conflicts of interest.

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