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# Correlation of Peak Expiratory Flow Rate and Length of Exposure Among Petrol Pump Workers

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## Abstract

Background: Occupational exposures to petrol / diesel vapors have been shown to affect functioning of different systems of the body. So the present study is planned to assess the Peak Expiratory Flow Rate of occupational exposureamongpetrol pump workers. Objectives: To find out the Peak Expiratory Flow Rate among occupational exposed petrol pump workers. Methods: Study Design was an observational study and Study type was cross sectional. The inclusion criteria were males, age between 20 to 50 years, working as petrol/diesel filling worker at the petrol pump for at least 1 year and 8 hrs/day. Exclusion criteria were smokers, history of any respiratory or cardiac illness, musculoskeletal abnormalities involving upper trunk or rib cage and neuromuscular disease. 50 controls and 50 cases (fuel station workers) were selected from Tambaram to Chengalpattu petrol pump based on these criteria. Their Peak Expiratory Flow Rate test is done and is compared with healthy nonsmokers. Results: A significant decrease in PEFR (t = 17.92; P = 0.001) was observed between both groups. The correlation coefficient for duration of exposure vs PEFR was r = - 0.934, which was statistically significant (P = 0.001). The chi-square association also demonstratesa significant association ($X^2$=63.460; P=0.001) between the number of years of work experience vs PEFR. Conclusion: The present study suggests that long term exposure to petrol vapors and diesel fumes leads to decrease in respiratory function among petrol pump workers.

## Keywords

PEFR, Lung Function, Petrol Pump Workers

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## 1. Introduction

AnIncreasing number of vehicles with emission of burnt fuel is a major cause of air pollution. Air pollution from vehicles is an inevitable part of urban life throughout the world. Various occupational solvents like benzene, lead, carbon monoxide and atmospheric polluted air are absorbed in to human body either through respiratory tract or epidermal contact leads to primary respiratory symptoms and impairment of pulmonary & dermatological functions. [1, 2, 3].

In India about 78% cities exceed the PM10 standard. 90 cities have critical levels of PM10; 26 have the most critical levels, exceeding the standard by over three times. About 10% of the cities exceeds the $NO_2$ standard. Air pollution monitoring network has doubled between 2005 and 2010 from 96 to 180 cities. During this period the cities with low level of pollution have fallen from 10 to 2, while the number of critically polluted cities has increased from 49 to 89. [4]

Although most of the cities that had fallen under the above survey are not North and North east cities like Delhi, Meerut, Noida. But with the increasing number of vehicles at an alarming rate. Petrol and diesel pump workers worked at fuel filling stations are constantly exposed to the mixture of polluted air and vapors of petrol and diesel fumes and vehicle exhaust at high ambient concentrations. Therefore group of workers has well defined and marked systemic pulmonary

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inflammatory response. [5, 6]

Self servicepumps are not widely available in India, especially in Tamilnadu and thus petrol products are dispensed by pump attendants. So there may exist a impairment in lung function and a compromised respiratory health among these workers. A near-empty petrol tank consists of a layer of liquid petrol with a volume of air saturated or nearly saturated with petrol vapour. [7]

When the tank is filled at the pump, the vapour-saturated "head space" air is expelled through the filling channel, around the nozzle, and into the breathing zone of the attendant filling the tank. This exposure process is repeated as many times the attendant fills a tank in a work shift. Exposure is heavier in the context of lack of protective devices to minimize leakages at the nozzles in petrol stations, such as vapour recovery devices built into the pump nozzles. [7]

With the increase use of petroleum and petroleum products there is a greater opportunity for humaningestion and addiction of these toxic substances. Benzene and toluene are major monocyclic hydrocarbon emission. Benzene is highly volatile and it is the most usual route of exposure in human body through the inhalation of the vapor. Therefore the fuel pump workers are highly exposed to the toxic effect of benzene in petrol. [8]

Peak Expiratory Flow Meter is a valuable clinical tool in diagnosis and management to follow up for the respiratory diseases. The Peak Expiratory Flow Rate can be used as a prime indicator for individual health and to evaluate, whether there is a correlation between peak expiratory flow alteration and duration of exposure among the fuel pump workers. [9]

So this study is designed to evaluate the peak expiratory flow among the petrol pump workers with the help of thePeak Expiratory Flow Meter.

# 2. Methodology

Study Design was observational and Study type was cross sectional. The Inclusion criteria were males, age between 20 to 50 years and working as petrol/diesel filling worker at petrol pump since > 1 year at least for 8hrs/day. Not using any protective mask, cap and other protective equipments, Exclusion criteria were smokers, history of any respiratory or cardiac illness, musculoskeletal abnormalities involving theupper trunk or rib cage and neuromuscular disease.

50 subjects those are unexposed to fuel and those who also fulfill the exclusion criteria are conveniently selected for the studyand 50 subjects who fulfill both the inclusion and exclusion criteria were selected from Tambaram to Chengalpattu petrol pump stations, Kancheepuramdistrict. The procedure of the study was explained and their consent was obtained. Their Peak Expiratory Flow Rate test was obtained with the help of Peak Expiratory Flow Meter which is a reliable and valid device and wascompared with healthy nonsmokers.

## 2.1. Procedure

Demographic data were obtained and recorded in the proforma before the application ofa procedure. And year of service was documented with the informed consent from the subject. The technique of breathing maneuver was taught, which is adeep inspiration followed by force full expiration, with maximum effort into the mouth piece was clearly explained and demonstrated for the subjects. Successful practices on 3 consecutive attempts were then made. From that the best of 3 values were recorded and then compared withthe control group.

## 2.2. Data Analysis

Data was analyzed using SPSS version 20, data are tabulated and descriptive statistics were expressed in frequency and percentage. Inferential statistics were done using independent sample t – test and the Pearson correlation at level of significance (P<0.001) and chi-square test for association.

**Table 1.** Comparison of PEFR between petrol pumps workers and control group.

| Compare | N | MEAN | S.D | t-value | P-value |
|---|---|---|---|---|---|
| Petrol | 50 | 357.8 | 74.7 | 17.92 | 0.001 |
| Control | 50 | 559.4 | 27.0 | | |

There was a significant decrease in PEFR between the study group and control group shows that t-value is 17.92 and P-value is 0.001.

**Table 2.** Association of year of experience in petrol pump workers vs PEFR.

| Year ofExperience | PEFR | | | Total |
|---|---|---|---|---|
| | 230 – 330 | 331 – 430 | > 430 | |
| 1 – 5 | 0 | 3 | 12 | 15 |
| 6 – 10 | 5 | 18 | 0 | 23 |
| 11 – 15 | 12 | 0 | 0 | 12 |
| Total | 17 | 21 | 12 | 50 |

$X^2$ =63.460 P=0.001

It is inferred from Table 2 that, there was significant association ($X^2$ =63.460 P=0.001) observed between the number of yearsof experience in petrol pump workers and PEFR. Further, from cross tabulation, it is inferred that when year of experience is more, the corresponding PEFR is less and vice versa.

**Table 3.** Correlation between duration of exposure and PEFR among petrol pump workers.

| Year of service vs PEFR | "r" | P-value |
|---|---|---|
| | -0.934 | 0.001 |

This table infers that there exist a negative correlation between the duration of exposure and PEFR among petrol pump workers levels is -0.934 at 0.001. It indicates that anincrease in duration of exposure lead to decrease in PEFR.

## 3. Results

The mean of PEFR for petrol pump workers was 357.8 ± 74.7 liters/min whereas the mean PEFR for controls was 559.4 ± 27.0 liters/min. Further on comparison of significant difference in PEFR (t = 17.92; P = 0.001) was observed between both groups. TheCorrelation coefficient for duration of exposure in petrol pump vs PEFR was r = - 0.934, which was statistically significant (P = 0.001). The chi-square association also demonstrates a significant association ($X^2$=63.460; P=0.001) between the number of year of work experience in petrol pump vs PEFR

## 4. Discussion

This study aimed to assess PEFR of petrol pump workers and to examine the relationship between exposure to petrol vapor and PEFR performance. The study showed a significant reduction of PEFR in cases compared with control as evidence in PEFR mean value was 357.8 and 559.4 respectively.

Other studies Ezejindu DN et al, Neena Sharma et al. Ravi B. Solanki et al. have demonstrated similar reductions in spirometryamong petrol pump workers compared with their age – matched controls. [10, 8, 5] Begum and Rathna also found a significant reduction in PEFR among petrol pump workers ages 18 – 30 years in the Mysore city. [11]

Peoples who are not exposed to noxious particles have been better lung function with higher PEFR compared to those exposed to noxious particles because air pollution has a negative effect on adult lung function. Inhalation of noxious particles causes abnormal inflammatory response which leads to airflow limitation.

From the result of this research there was a change in the mean PEFR of the test group based on their years of exposure. The mean PEFR had shown to decrease with increased years of exposure. However, this change was also statically significant (P-value 0.001). This is also similar to the reportbyAkor-Dewuet al. who carried a research to assess pulmonary function tests among adult male petrol station attendants. [7]

Results from the current study showed that PEFR when correlated with year of exposure to petroleum has an inverse relationship. This means that an increase in the years or time of exposure to petroleum would contribute to a decrease in the PEFR. This is in accordance with earlier reports by Ezejindu D Nand Dr. Bamidele Olaiya Adeniyi. [10, 12]

In this present study, we found that PEFR was decreased in petrol pump workers when compared to control group and the decrease was more in workers working for more than 5 years. When compared to those who have worked for less than 5 years. There was a significant association ($X^2$=63.460; P=0.001) observed between thenumber of years of experience in petrol pump workers and PEFR.

Our finding suggests that exposure to petrol vapors, fumes, diesel exhaust and airborne particulate matter leads to impairment in lung functions. This impairment increases with increased duration of exposure. Similar findings were reported by Neena Sharma et al. and ArpanaBhide et al. [8, 4, 14, 15].

Adverse effect of petrol vapour on lung functions may occur through several ways. It has been suggested that exposure to particulate matter from environmental pollution in combination with exposure to petrol vapours may induce airway inflammation.

This study strongly shows the alarming effect of continuous exposure of petrol products and pollution from vehicles among petrol pump workers and also emphasizes the need for petrol attendants to wear protective equipment or be given better engineering controls on their equipment during duty, thus reducing their exposure to petrol vapour. They should also be encouraged to have periodic assessments to detect changes in their lung function over time.

## 5. Conclusion

Long term exposure to petrol vapors and diesel fumes leads to decrease in respiratory function among petrol pump workers. The PEFR values gets compromised with increase in years of experience in their work at Petrol Pumps PEFR values were so reduced in workers more than 10 years of experience which arises a necessity to ensure the need of protective equipment to improve the Quality of life the workers and educate them on the ill effects of the reduction in respiratory functions

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