# Evaluation of Respiratory Functions in Petrol Pump Workers at Nanded

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***Research Article***

***Abstract:*** **Introduction:** In India petrol pump workers are continuously exposed to petrol and diesel fumes as well as hazardous vehicle exhausts and other environmental pollutants at their working places. They do not use any protective equipments and their personal hygiene is also variable. **Aims and Objective:** The aim of present study is to assess the extent of derangement in pulmonary functions of petrol-pump workers in India and also the relation between duration of exposure and degree of derangement in pulmonary functions. **Material and Methods:** Study group consisted of eighty non smoker petrol pump workers who were further divided into three groups according to their duration of exposure. Control group consisted of eighty healthy nonsmoker age matched males. The pulmonary function tests of cases and controls were performed at their workplace by using a Med-Spiror. **Result:** The results showed that the pulmonary functions (FVC, FEV1, MVV and PEFR) were decreased in petrol pump workers as compared to controls. The pulmonary functions were found to be progressively deranged with duration of exposure of petrol and diesel fumes and vehicle exhaust which is statistically significant. **Conclusion:** Our findings are suggestive of occupational hazards in petrol pump workers. So we suggest periodic monitoring of pulmonary functions in petrol pump workers for early detection and subsequent treatment of pulmonary diseases. Use of protective mask at work place can also decrease morbidity in them. Also control strategies can be adapted to reduce benzene concentration in air emission including air evaporation. Improvement in engine design, soot filters and fuel modification such as use of biodiesel can be helpful.

***Keywords*****:** Petrol Pump workers, pulmonary function tests, FVC, FEV1, MVV, PEFR.

## Introduction

Health problems posed by the pollutants at the work environment of an individual are closely linked to the nature and level of exposure to hazardous chemicals in these pollutants(1). Beside this, rapidly multiplying number of automobiles in most towns and cities and corresponding increase in air pollution is a cause of grave concern (2). Various epidemiological studies have documented decrements in pulmonary function and various other health problems associated with long-term air pollution exposure (3–6). Petrol is a mixture of volatile hydrocarbons, while diesel is a distillate of petroleum which contains paraffin, alkenes and aromatics (7). About 95% of the components in petrol vapour are aliphatic and alicyclic compounds and less than 2% aromatics (8). The benzene content of petrol has typically been in the range 1–5%, but may have risen following the removal of lead additives (9). Both petrol and diesel undergo combustion in automobile engines and give rise to combustion-derived nano particles (CDNPs). These particles are highly respirable and have a large surface area which can carry a larger fraction of toxic. hydrocarbons and metals on their surface. They can remain airborne for longer time periods and can be deposited in greater numbers and deeper into the lungs than the large-sized particles (10). Petrol evaporates more readily in hot than cold countries. In India, petrol-pump attendants are the norm rather than self service, increasing the opportunity for exposure. Petrol-pump attendants do not wear personal protective equipment and personal hygiene is variable in the workplace. Average daily exposure of petrol pump workers to these chemicals generally exceeds about 10 hr/day. Some of them are working for more than ten years now. Hence Petrol pump workers (filling attendants) are continuously exposed to the organic and inorganic substances present in the petrol (11). Petrol-pump workers who are exposed to the petrol fumes exhibit a number of clinical signs and symptoms which may be due to benzene toxicity. Symptoms like chronic cough, wheezing and breathlessness have been reported on exposure to these pollutants (4,6). At high concentrations, well defined and marked systemic pulmonary inflammatory response is also observed in healthy human volunteers (12). Several animal studies have also demonstrated that air pollutants were responsible for the altered lung function (13-15). Hence, the present study is undertaken to assess the extent of derangement in pulmonary functions of petrol-pump workers in India and also the relation between duration of exposure and degree of derangement in pulmonary functions.

## Material and Methods

The study was carried out in the Department of Physiology at Dr. Shankarrao Chavan Government Medical College Nanded. The study group consisted of

eighty healthy non-smoker males in the age group of 20–40 years who were working in different petrol pumps. Further the study group is divided into three groups according to their duration of work at petrol pump. Group I consisted of cases who were working at petrol pump for less than 1year. Group II consisted of cases who were working at petrol pump for 1-5 years. Group III consisted of cases who were working at petrol pump for more than 5 years. They were selected from the petrol pumps located in the vicinity of the institution. While eighty age matched healthy males nonsmokers, selected from students and employees of Dr S.C. G.M.C. Nanded served as control group. Subjects with clinical abnormalities of the vertebral column and the thorax, diabetes mellitus, pulmonary tuberculosis, bronchial asthma, chronic bronchitis, bronchiectesis, emphysema and malignancy and those who were drug addicts, cigarette smokers, tobacco chewers and those who had undergone abdominal or chest surgery and those not willing to give consent for participation were excluded from the study. The ethical committee clearance was taken and an informed written consent was taken after explaining the procedure to the subjects. A standard proforma was used to record particulars of the subjects, which included age, height, weight, and duration of work in petrol stations and history of any respiratory diseases in the past or respiratory symptoms at present. The respiratory system was examined clinically to rule out any obvious lung pathology. The pulmonary function tests of cases and controls were performed at their workplace by using a Med-Spiror (Recorders and Medicare System, Chandigarh). It is a computerized spirometer which is designed to be used with electromechanical pneumotach. The testing procedures are quite simple and non invasive and are harmless to the patients. Only 2 maneuvers were required from the subject to accumulate all the test data, a forced vital capacity and maximal voluntary ventilation. The Forced Vital Capacity (FVC) , Forced Expiratory Volume in 1 second (FEV1) and maximum voluntary ventilation ( MVV ) were recorded by the Medspiror. Peak Expiratory Flow Rate (PEFR) was measured separately with a Wright's Peak Flow meter. All tests were performed between 1400 and 1600 hours to exclude the bias of circadian rhythms (3). All the gas volumes were corrected to B.T.P.S (Body temperature, ambient pressure and saturated with water vapour) automatically by the instrument.

### Statistical analysis

The data of pulmonary function tests were presented as the Mean ± Standard deviation for each of the parameter. The control and study groups were compared by using unpaired't' test . The observations among different study groups were analyzed using ANNOVA test.

## Observations and Result

**Table 1:** Distribution of study population according to age, height and weight

| Variable | Cases (Mean±SD) | Control (Mean±SD) | Level of significance* |
|---|---|---|---|
| Age (yrs) | 29.40±5.75 | 27.20±4.80 | p>0.05 |
| Weight (Kgs) | 54.45±8.80 | 58.65±10.72 | p>0.05 |
| Height (cm) | 154.36±6.72 | 152.67±8.12 | p>0.05 |

*Unpaired T test

Table 1 shows that mean value of the ages of cases was 29.40±5.75 and that the mean value of controls was 27.20±4.80 and the difference was statistically insignificant (p>0.05). The mean value of the weights of cases was 54.45±8.80 and that the mean value of controls was 58.65±10.72 and the difference was statistically insignificant (p>0.05). The mean value of the heights of cases was 154.36±6.72 and that the mean value of controls was 152.67±8.12 and the difference was statistically insignificant (p>0.05).

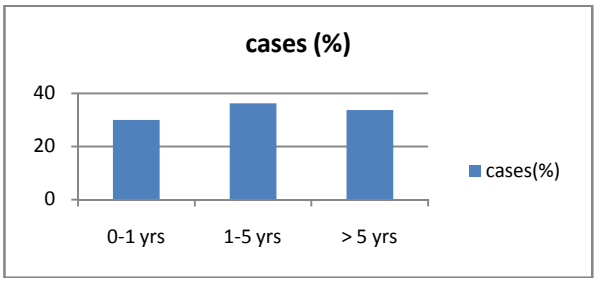


***Figure 1:*** Distribution of cases (n=80) according to the duration of exposure

Figure 1 shows distribution of cases according to the duration of exposure.30 % of the cases were having 0-1 years of exposure to petrol and diesel fumes as petrol pump workers. 37 % of the cases were having 1-5 years of exposure to petrol and diesel fumes as petrol pump workers and remaining 33 % of cases were having more than 5 years exposure.

**Table 2:** Comparison of pulmonary function tests among cases and controls

| PFTs | Cases (Mean±SD) | Controls (Mean±SD) | T-value* | Level of Significance |
|---|---|---|---|---|
| FVC (lit) | 2.59±0.42 | 3.42±0.68 | 9.28 | P<0.01 |
| FEV 1 (lit) | 2.47±0.61 | 3.29±0.57 | 8.78 | P<0.01 |
| PEFR (lit/m) | 5.61±1.53 | 6.39±1.69 | 3.06 | P<0.01 |
| MVV (lit/m) | 73.6±11.3 | 85.2±12.5 | 6.15 | P<0.01 |

*Two sampled Independent T test

Table 2 shows the comparison of pulmonary function tests between cases and controls. Forced vital capacity (FVC), forced expiratory volume at the end of 1st second (FEV1), peak expiratory flow rate (PEFR) and maximal voluntary ventilation (MVV) were found to be significantly decreased ($p<0.01$) in petrol pump workers as compared to controls.

**Table 3:** Pulmonary function tests among cases according to the duration of exposure

| PFTs | Duration of Exposure | | | Level of significance* |
|---|---|---|---|---|
| | Group I (0-1 yrs) | Group II (1-5 yrs) | Group III (> 5 yrs) | |
| FVC (lit) | 3.27± 0.39 | 2.6± 0.31 | 2.2±0.29 | P<0.001 |
| FEV 1 (lit) | 3.11± 0.59 | 2.43± 0.47 | 2.17±0.32 | P<0.001 |
| PEFR (lit/m) | 6.1± 0.9 | 5.47± 0.89 | 4.98±1.1 | P<0.001 |
| MVV (lit/m) | 81.9± 9.9 | 74.3± 8.7 | 66.1±9.1 | P<0.001 |

*ANNOVA test

Table 3 shows comparison of pulmonary function tests among different groups of cases according to the duration of exposure. The mean values of FVC were 3.27± 0.39, 2.6±0.31 and 2.2±o.29 in Group I, Group II and Group III respectively. On Comparison it was found that forced vital capacity (FVC) progressively decreased with duration of exposure and the decline was statistically significant ($p<0.001$). The mean values of FEV1 were 3.11± 059, 2.43±0.47 and 2.17±o.32 in Group I, Group II and Group III respectively. On Comparison it was found that forced expiratory volume at the end of 1st second (FEV1) progressively decreased with duration of exposure and the decline was statistically significant ($p<0.001$). The mean values of PEFR were 6.1± 0.9, 5.47±0.89 and 4.98±1.1 in Group I, Group II and Group III respectively. On Comparison it was found that peak expiratory flow rate (PEFR) progressively decreased with duration of exposure and the decline was statistically significant ($p<0.001$). The mean values of MVV were 81.9± 9.9, 74.3±8.7 and66.1±9.1 in Group I, Group II and Group III respectively. On Comparison it was found that maximal minute ventilation (MVV) progressively decreased with duration of exposure and the decline was statistically significant ($p<0.001$).

## Discussion

In the present study, the pulmonary functions (FVC, FEV1, MVV and PEFR) were decreased in petrol pump workers as compared to controls. The pulmonary functions were found to be progressively deranged with duration of exposure of petrol fumes and diesel exhaust which is statistically significant. These derangements in pulmonary functions may be due to longer duration of working hours and continuous exposure to petrol and diesel fumes. Similar findings were observed in cats following long term exposure to diesel exhaust (14). Singhal et al found statistically significant decrease in FVC, FEV1, and PEFR in petrol pump workers who were exposed to petrol and diesel fumes (11). Similarly Aparjita et al also found statistically decrease in FVC, FEV1, PEFR in petrol pump workers .However MVV is s decreased but the decline is not statistically significant(16). At high ambient concentrations, acute short-term diesel exhaust exposure produced a well-defined and marked systemic and pulmonary inflammatory response in healthy human volunteers, which is underestimated by standard lung function measurements(12) However in our study, the study group was exposed to petrol and diesel exhaust for longer duration, leading to derangement in pulmonary functions. As most of the petrol pumps are on heavy traffic roads, beside petrol and diesel exhaust these workers are also exposed to heavy air pollution. The petrol and diesel exhaust particle are very small in size about 0.2 nm . Owing to their small size, these particles have large surface area so they can carry large amount of toxic compounds, such as hydrocarbons and metals on their surface. These particles can remain airborne for longer period and can be deposited deeper in smaller airways of lung (17). Petrol-pump attendants do not wear personal protective equipment so risk of development of pulmonary diseases is very high.

## Conclusion

The present study demonstrated derangement pulmonary functions in petrol pump workers, which is similar to findings by previous studies. Since most of the individuals are likely to remain asymptomatic till significant pulmonary damage results, we suggest pre-employment and periodical monitoring of pulmonary functions of petrol pump workers. So that early detection and subsequent treatment of pulmonary diseases will be possible. Use of protective mask at work place can also decrease morbidity in them. Some of the studies showed benzene in petrol may be exacerbating factor for the symptoms. So control strategies must be adapted to reduce benzene concentration in air emission including air evaporation. Improvement in engine design, soot filters and fuel modification such as use of biodiesel can be helpful. The data suggests that these derangements in pulmonary functions are due to continuous exposure to toxic components in petrol and diesel fumes as well as environmental air pollutants. But it remains unclear which of these two factors contributes more for decline in pulmonary functions. So we suggest a detail comparative study of pulmonary functions between traffic police who

are exposed to only environmental air pollutants and petrol pump workers who are exposed to petrol fumes and air pollutants both.

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