Research Article

A study of pulmonary function tests in petrol pump workers

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Abstract

Petrol pump workers are constantly exposed to solvents and petroleum products. The aim of this study was to find out effect of chronic exposure to solvents like benzene and carbon monoxide and other petroleum products in petrol filling workers on respiratory functions. Study group consisted of 70 healthy non-smoker petrol filling workers, with exposure duration between 1-15 yrs. Study group was again divided in two groups based on their duration of exposure i.e. 1 - 5 years and 5 - 10 years. While 70 healthy subjects of same age group served as controls. Recording of pulmonary function test of study and control group was done by using computerised spirometer. Statistical Analysis was done by using 't' test. There was statistically highly significant decrease in FEV1, FVC and PEFR in petrol pump workers as compared to controls. There was no any significant difference in ERV of petrol pump workers and controls. Also there was statistically significant decrease inFEV1, FVC and PEFR in subjects who are exposed for 5 – 10 years as compared to subjects exposed for 1-5 years. From above results we can conclude that chronic exposure to petroleum products in petrol pump workers leads to both restrictive and obstructive pattern of lung disease. As duration of exposure increases, severity also increases.

Keywords: FVC (Forced Vital Capacity), FEV1 (Forced Expiratory Volume at end of one second), PEFR (Peak Expiratory Flow Rate), ERV (Expiratory Reserve Volume), Petrol pump workers.

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INTRODUCTION

Millions of workers in a variety of occupational settings are exposed to hazardous substances. These substances include organic chemicals, intermediates, by products or end products.[1] Petrol (or gasoline) is a volatile and inflammable petroleum liquid hydrocarbon mixture primarily used for internal combustion of engines. The volatile nature of petrol and diesel increases its concentration in air. Petrol filling workers are continuously coming in contact with these hydrocarbons by virtue of their occupation.[2] Petrol is a complex mixture of hydrocarbons produced by mixing functions obtained from the distillation of crude oil with brand specific additives to improve performance.[3] It was first used as a product named by a London chemical company (Carless, Catel and Leonard) at the end of 19th century. The term, petrol is an abbreviation of petroleum derived from the Greek word 'Petros' (meaning rock or stone) and oleum (oil).[4] Gasoline station workers who are exposed to various products (petrol, diesel) contain various organic compounds such as benzene, toluene, ethyl benzene are well known carcinogens.[5,6] Petrol pump workers come in contact with these B-TEX compounds through inhalation, ingestion and dermal contacts. However, the main route of exposure is the respiratory system i.e. inhalation. Petroleum products and its exhausts are causing significant health problems and symptoms like chronic cough breathlessness and wheezing.[7, 8] High concentration of these products cause marked systemic pulmonary inflammatory response. Animals which are exposed to diesel exhausts have also shown to develop altered lung functions.[9, 10] There is no database available on such study in our area. Hence the present study attempts to evaluate the changes in pulmonary function tests like FVC, FEV1, PEFR, ERV of petrol filling workers in Sangli city.

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MATERIAL AND METHOD

Present study involves 140 subjects who were non-smokers. A total of 70 workers were selected from various busy petrol pumps (where more than 50 vehicles per day were filled) in the city of Sangli. Minimum duration of exposure was 1 year having minimum 8-10 hours daily exposure. They were further divided in to two study groups depending on their duration of exposure as Group I (1-5 years) and group II (5-10 years). They were compared with age matched healthy male non- smokers i.e. control group. Approval for the study was taken from Institutional Ethical Committee. Control group was taken from paramedical staff of same socioeconomic status from Bharati Vidyapeeth Medical College and Hospital Sangli. For this work permission was taken from President and owners of each petrol pump. With prior permission and appointment petrol pump workers were interacted with the help of interview schedule. History was taken during visit to the petrol pump. Then they were taken to the Bharati Vidyapeeth Medical College and Hospital Sangli for PFT testing. An informed written consent was taken after explaining the procedure to the subjects.Screening of each worker was done with proforma. History was asked about any cardiac or respiratory diseases. Examination was done on them at Bharati Vidyapeeth Medical College and Hospital Sangli by physician and then pulmonary function tests were performed.

Exclusive criteria

1. Chronic smokers
2. History of cardiac disease
3. Persons suffering from COPD
4. Family history of asthma or allergic disease
5. Any other major systemic illness
6. Subjects performing any type of exercise, yoga or pranayama

PFT was done by using electronic computerized portable spirometer (Spiro Excel PC based, recorder and Medicaid system, Chandigarh, India). All the subjects were made familiar with the instrument and the procedure for performing the test. The data of the subjects as regards to name, age, height, weight, sex, date of performing the test were fed to the computerized spirometer. Recording of FVC, FEV1, PEFR and ERV parameters were done. Three readings were taken and best reading amongst them was chosen. Comparison between case and control, Group I and Group II was done by using students unpaired 't' test.

RESULT

Table 1: Showing mean and standard deviation of pulmonary parameters in petrol pump workers and control group

Parameters	Study Group		'P' value
	Control Mean±SD	Petrol pump workers Mean±SD	
FVC (L)	4.19±0.63	3.48±0.61	0.0001**
FEV1 (L)	3.73±0.8	3.03±0.74	0.0001**
PEFR (L/sec.)	4.09±1.34	3.80±1.68	0.029*
ERV (L)	1.11±0.71	0.98±0.61	0.249

** - Highly significant *- significant

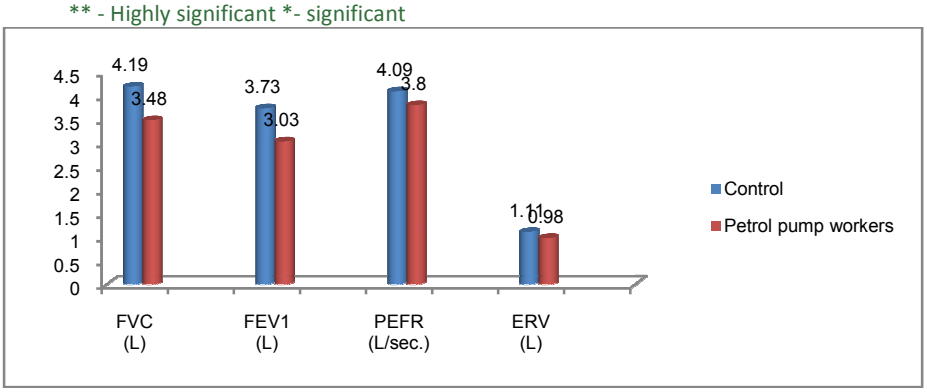
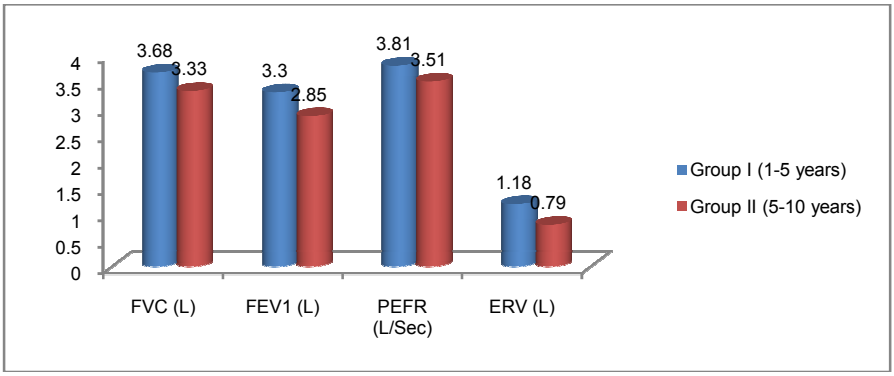


Table 2: Showing mean and SD of pulmonary function tests in petrol pump workers according to the duration of exposure

Parameters	Group I (1-5 years) Mean ±SD	Group II (5-10 years) Mean ±SD	'P' value
FVC (L)	3.68±0.55	3.33±0.69	0.038*
FEV1 (L)	3.30±0.59	2.85±0.70	0.011**
PEFR (L/Sec)	3.81±1.61	3.51±1.68	0.49
ERV (L)	1.18±0.60	0.79±0.59	0.016*

** - Highly significant *- significant



DISCUSSION

Rapidly multiplying number of automobiles vehicles and petrol pumps has increased air pollution. We have tried to assess dynamic lung functions in petrol pump workers. These workers are constantly exposed to exhaust fumes and fuel vapours throughout the day which causes decline in the lung functions. The parameters like age, weight and BMI of above case and control groups were almost similar. In our study there was statistically highly significant decline in FVC among the petrol pump workers as compared to controls. Also there was statistically significant reduction in FVC in group II i.e. exposed for 5 to 10 years as compared to group I i.e. exposed for 1 to 5 years. Our findings are in accordance with study done by Nazia Uzma *et al*[11] and Mayank Singhal *et al*[12] who also found positive correlation of FVC and duration of exposure. In Workers exposed to diesel and automobile exhaust there is increased airway resistance leading to reversible reduction in FVC.[13] Forced Expiratory Volume in one second (FEV1) has been statistically significantly decreased in petrol pump workers as compared to controls. The mean values of FEV1 is decreased as years of exposure is increased. This decreased value was found to be statistically significant. Our results coincides with those of Keshavchandrani *et al*.[14] Peak Expiratory Flow Rate (PEFR) was statistically significantly reduced in petrol pump workers as compared to controls. Our results corresponds with Nazia Uzma *et al* indicating peripheral airway obstruction (PAO)[15]. But there was no significant change in PEFR with increasing duration of exposure. Expiratory Reserve Volume (ERV) was also decreased in petrol pump workers as compared to controls which was statistically not significant. In workers exposed for 5 -10 yrs as compared to workers exposed for 1-5 years the ERV is decreased significantly.[16] In our study reduced values of FVC and FEV1, PEFR in petrol pump workers suggest that chronic exposure to petroleum products leads to restrictive lung disease with obstructive element. Similar findings were noted by Rao *et al*. In their study the findings reported are reduced ERV, FVC and FEV1 suggesting restrictive and obstructive lung diseases.[17] Accumulation of dust laden macrophages leads to varying degrees of wall thickening and remodelling in terminal and respiratory bronchioles. This small airway damage might be cause of reduced pulmonary functons.[18] In our study petrol pump workers showed decline in their lung functions having mixed pattern of restrictive and obstructive lung disease, Severity increases with increase in duration of exposure. There by confirming that regular exposure of fuel vapours (hydrocarbons) and automobile exhaust for more than 5 yrs. have adverse effects on respiratory system. So the present study showed that the petroleum products affect the pulmonary function tests. As the years of exposure increases, petrol pump workers are more likely to develop mixed type of lung disease. Since most individuals working in petrol pump remain asymptomatic till significant pulmonary damage results, regular monitoring of lung functions is desirable.

CONCLUSION

The present study concludes that:-

1. The petrol pump workers are highly susceptible for respiratory function impairment as there was statistically significant reduction in FVC, FEV1 and PEFR in petrol pump workers as compared to controls
2. Long term exposure to the petrol vapours leads to mixed pattern of lung disease in petrol pump workers due to petrol and fuel.

Early recognition and removal of sensitive workers from working place before chronic impairment develops will help to prevent severity.

RECOMMENDATION

To minimize the health hazards, periodic health check-up along with pulmonary function tests every year should be done. Health check-up camps should be arranged frequently. This has to be complimented by effective personal protection by petrol pump workers like gloves, apron, long shoes, appropriate respiratory protective equipments i.e. anti-pollution masks etc. Station workers

should be advised to do regular physical exercise and pranayama to strengthen the respiratory system. Health education regarding adverse effects of fuel vapours and automobile exhaust must be given.

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