

## Original Article

# PULMONARY FUNCTION TESTS IN PETROL PUMP WORKERS IN CHITTOOR DISTRICT

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## ABSTRACT

**AIMS AND OBJECTIVES:** The main aim of the study was to assess the PFT in petrol pump workers who were exposed to petrol and diesel. In addition the effect of the duration of the service at the petrol pumps was also studied and these changes were compared with those of age matched healthy controls.

**MATERIALS AND METHODS:** The study comprises of 60 petrol pump workers who were categorized into two groups depending on duration of exposure. Thirty healthy ages, non smoker males served as controls. Each subjects age, smoking habits, the duration of exposure and health conditions were recorded. Their PFT were studied at their work place by using computerized spirometer. 2010 model parameters of PFT are FVC, TV, FEC, FEV/FC, FEF 25-75%, FEF 75-85%, PEF and MVV.

**RESULT:** Results showed statistically significant decrease in the values of TV, FVC, FEV, FEF 25-75%, FEF 75-85%, FEV/FC, PEF and MVV in petrol pump workers who have worked for more than 5 years when compared to control group. The result shows statistically decreased in value of TV, FVC, FEV, FEF 25-75% and MVV in petrol pump workers who have worked for below 5 years when compared to control group.

**CONCLUSION:** Petrol pump workers are continuously exposed to fuel vapours and automobile exhaust. The average duration of daily exposure is about 8 hrs/day. These pollutants affect even other organs in the body. In order to prevent lung damage in petrol pump workers awareness programmes should be conducted and also pre employment check up and periodic medical checkups which include pulmonary function tests should be conducted to detect any lung function impairment at the earliest.

**KEYWORD:** Petrol and diesel fume; Pulmonary Function Test (PFT); Tidal Volume.

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## INTRODUCTION

India is a rapidly developing country and automobiles plying on roads are increasing each day. This has led to an increase in petrol pump stations and petrol pump workers and also exposure of petrol pump workers to vapours of petrol and gases from exhaust of automobiles.<sup>1</sup> Petrol vapours and gases from automobile exhaust have a deleterious effect on the respiratory system. In the present study an attempt has been made to study the effect of inhalation of petrol vapour and gases from automobile exhaust on lung functions of petrol pump workers.

A long term exposure to the air pollutant leads to effects of respiratory functions. Air pollutants and chemicals like benzenes, lead, CO<sub>2</sub>, NO<sub>2</sub>, CO etc; play a role in the pathogenesis of respiratory diseases.<sup>2</sup> Petrol also called gasoline is a complex combination of hydrocarbons. About 95% of components in petrol vapours are aliphatic and cyclic compounds and less than 2% are aromatics. Prolonged exposure to air pollution and petroleum vapors causes bronchoconstriction.<sup>3</sup> Mucosal irritation and alveolar swelling leads to obstructive and restrictive disorders of lungs.

## MATERIALS AND METHODS

This study was conducted in the department of Physiology, SVIMS, TPT. The study group comprised of 60 males who were working in different petrol pumps. Their age, smoking habits, duration of exposure, physical status and health conditions were recorded by using a questionnaire.

After recording their brief history, their examination was done as per the proforma which was attached.

Exclusion Criteria: Smokers, Emphysema, pulmonary tuberculosis, Bronchial asthma, Chronic Bronchitis, Diabetes mellitus, Malignancy and those who were drug and tobacco addicts were excluded. The study group was categorized according to the duration of the services at the petrol pumps which was two groups.

GROUP	DURATION OF SERVIES	NO.OF CASES
1.	Below 5 years	30
2.	Above 5 years	30

There were 30 controls which comprised age and sex matched healthy adult males. Nonsmokers working in college of Physiotherapy, College of Nursing and M.Sc students. The PFT were performed at their work place by using a digital spirometer 2010. The testing procedure is quite simple, invasive and harmless to the subject. The FEV, FEV/FC, FEF 25-75%, FEF 75-85%, FEF and MVV, values are calculated. The data was analyzed by using the computer software, MS EXCEL, statistical package of social science. The mean and SP were calculated and reported for the quantitative variables. The statistical difference, in the mean values was tested by using one way analysis of variance. P value (0.05) are considered as statistically significant.

## RESULTS AND TABLES

**Table 1:** Showing the Means and SD of the above 5 Years, Below 5 Years and Controls.

VARIABLES	Above 5years	Below 5years	Controls BMI
HIGHT	1.640±0.07	1.630±0.12	1.660±0.08
WEIGHT	69.03±11.65	69.0±11.09	64.08±6.54
BMI	25.95±5.43	26.38±6.11	27.57±22.21

Table1 shows that mean values of the height below 5 years 1.63±0.12 above 5 years 1.64±0.07

and that the mean values of the controls was 1.66±0.08 and that the differences was not significant. the mean The mean values of the WEIGHT the subject was above 5 years 69.03±11.09 below 5years 69.03±11.65 and the mean values of the control group 64.08±6.54 and differences was statistically not significant. And the BMI of the below 5 years 26.38±6.11, above 5 years 25.95±5.43 and controls was 27.57±22.21 the difference was statistically not significant.

**Table 2:** Showing the Means And SD of the above 5 Years, below 5 Years and Controls.

	HEGHT	WEIGHT	BMI
Above 5years compared with below 5 years	0.73	1	0.78
Above 5 years compare with controls	0.21	0.05	0.01
Below 5 years compare with controls	0.21	0.06	0.01

The P-values are depicted in the table No: 2

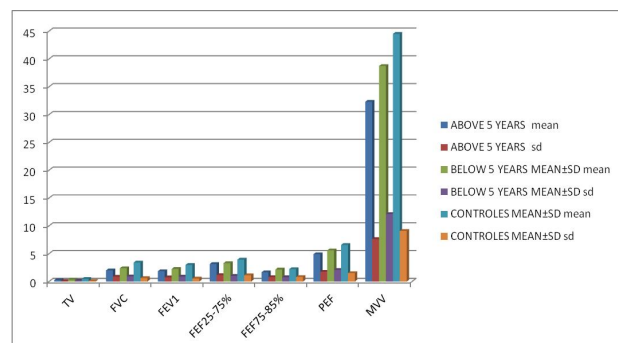
The height is not significantly increased in three groups (0.73,0.21,0.21).

The weight is not significantly increased when above 5 years compared with below 5 years(1.00), and below 5years compared with controls(0.06). But above 5 years compare with controls significantly increased (0.05).

The BMI is not increased in comparison of above 5 years and below 5 years(0.78) but when above 5 years compared with controls and below 5 years compared with controls are significantly increased(0.01,0.01).

**Table 3:** Showing the Means and SD of the above 5 years, below 5 years and Controls.

	ABOVE 5 YEARS		BELOW 5 YEARS MEAN±SD		CONTROLES MEAN±SD	
	Mean	Sd	Mean	sd	Mean	Sd
TV	0.26	0.11	0.34	0.18	0.47	0.11
FVC	2	0.87	2.39	0.93	3.42	0.62
FEV1	1.86	0.76	2.27	0.91	2.99	0.54
FEF25-75%	3.15	1.17	3.31	1.02	3.94	1.13
FEF75-85%	1.67	0.8	2.17	0.78	2.23	0.83
PEF	4.91	1.75	5.6	2.1	6.58	1.52
MVV	32.31	7.64	38.74	12.14	44.51	9.1



The mean values of the Tidal volume above 5 years of the subject was  $0.26 \pm 0.11$  and the mean values of the below 5 years  $0.34 \pm 0.18$  and that the mean values of controls was  $0.47 \pm 0.11$ . and that the differences was statistically non-significant.

The mean values of FVC above 5 years  $2.00 \pm 0.87$ , and below 5 years the mean values are  $2.39 \pm 0.93$  and that the mean values of the controls was  $3.42 \pm 0.62$  and the difference was statistically non-significant. The mean values of the FEV, above 5 years  $1.86 \pm 0.76$  and below 5 years  $2.27 \pm 0.91$  and that the mean values of the controls was  $2.99 \pm 0.54$  and that the differences was statistically non-significant. FEF 25-75% of the subjects was group-B  $3.15 \pm 1.17$  and group-A  $3.31 \pm 1.02$  and controls  $3.94 \pm 1.13$  and that the differences was statistically non-significant. The mean values of the FEF 75-85% group-B  $1.67 \pm 0.8$  group-A  $2.17 \pm 0.78$  and control group  $2.23 \pm 0.83$  and that the differences was statistically non-significant. The mean values of the PEF group-B  $4.91 \pm 1.75$  group-A  $5.6 \pm 2.1$  and that the mean values of the control group was  $6.58 \pm 1.52$  and that the differences was statistically non-significant. The mean values of MVV above 5 years  $32.31 \pm 7.64$ , group-A  $38.74 \pm 12.14$  and that the mean values of the controls was  $44.51 \pm 9.1$  and that the differences was statistically non-significant.

**Table 4:** Showing the Means And SD of the above 5 years, below 5 Years and Controls of FEV/FC.

	ABOVE 5 YEARS		BELOW 5 YEARS MEAN±SD		CONTROLES MEAN±SD	
	Mean	SD	Mean	SD	Mean	SD
FEV/FC	96.62	6.45	94.56	10.09	90.68	13.6

Shows that the mean values of the FEV/FC of the subject below 5 years mean and SD  $94.56 \pm 10.09$  and above 5 years mean and SD  $96.62 \pm 6.45$  and controls mean and SD  $90.68 \pm 13.6$  values was non-significantly increased group-A (0.21) and values was significantly increased in above 5 years (0.04) with compared to controls and below 5 years and above 5 years

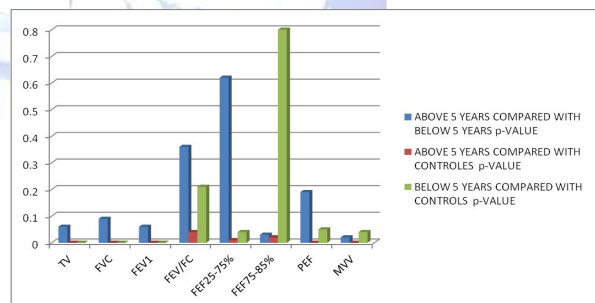
**Table 4:** Showing the Means And SD of the above 5 years, below 5 Years and Controls of FEV/FC.

	ABOVE 5 YEARS		BELOW 5 YEARS MEAN±SD		CONTROLES MEAN±SD	
	Mean	SD	Mean	SD	Mean	SD
FEV/FC	96.62	6.45	94.56	10.09	90.68	13.6

Shows that the mean values of the FEV/FC of the subject below 5 years mean and SD  $94.56 \pm 10.09$  and above 5 years mean and SD  $96.62 \pm 6.45$  and controls mean and SD  $90.68 \pm 13.6$  values was non-significantly increased group-A (0.21) and values was significantly increased in above 5 years (0.04) with compared to controls and below 5 years and above 5 years.

**Table 5:** Showing the P-value of the group-B below 5 years and control groups

	ABOVE 5 YEARS COMPARED WITH BELOW 5 YEARS p-VALUE	ABOVE 5 YEARS COMPARED WITH CONTROLES p-VALUE	BELOW 5 YEARS COMPARED WITH CONTROLES p-VALUE
TV	0.06	0	0
FVC	0.09	0	0
FEV1	0.06	0	0
FEV/FC	0.36	0.04	0.21
FEF25-75%	0.62	0.01	0.04
FEF75-85%	0.03	0.02	0.8
PEF	0.19	0	0.05
MVV	0.02	0	0.04



P-value of the "TV" was significantly decreased in both above 5 years (0.001) and below 5 years (0.00) experienced persons in the petrol pump when compared with controls. But when compared to be with above 5 years experienced persons in the petrol pump the P-values (0.06) was non-significantly decreased. P-values of the FVC significantly decreased in both above 5 years (0.00) and below 5 years experienced persons in the petrol pump when compared with controls. But when compared to above 5 years in the petrol pump the P-values (0.09) was non-significantly decreased. The P-values of the FEV value was significantly decreased in both above 5 years (0.00) and below 5 years (0.00) and experienced persons in the petrol pump when compared with control. But when compared between below 5 years and above 5 years in petrol pump workers P-value (0.06) was non-significantly decreased. The P-value of the FEV/FC value was significantly increased in below 5 years (0.04) when compared to controls.

increased in below 5 years (0.04) when compared to controls. Non-significantly increased in above 5 years (0.21) when compared with controls and below 5 years (0.36) compared with above 5 years. The P-value of FEF 25-75% values are significantly decrease in both above 5 years (0.04) and below 5 years (0.05) experienced in the petrol pump when compared with controls. But when compared with below 5 years with above 5 years experienced persons in the petrol pumps the P-value (0.62) was non-significantly decreased. The P-value of the PEF 75-85% values was non-significantly decreased in above 5 years (0.80) and in below 5 years (0.02) significantly decreased when compared with controls. But when compared between below 5 years and above 5 years experienced persons in petrol pump the P-value (0.03) was significantly decreased.

The P-value of the PEF value was significantly decreased in both above 5 years (0.05) and below 5 years (0.00) experienced persons in the petrol pump compared with controls. But when compared between below 5 years and above 5 years experienced person in the petrol pump workers the P-value (0.19) was non-significantly decreased. The P-value of the MVV value of was significantly decreased in both above 5 years (0.04) and below 5 years (0.00) experienced person in the petrol pump workers compared with controls but when compared between above 5 years and below 5 years experienced persons in the petrol pump the P-value (0.02) was non-significantly decreased.

## DISCUSSION

Our results showed that there was statistically significant decrease in TV, FVC, FEV<sub>1</sub>, FEF 25-75% and MVV values in group A as compared to control group. There was also statistically significant decrease in TV, FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, FEF 25-75%, FEF 75-85%, PEF and MVV values in group B as compared to control group. Also there was a statistically significant decrease in FEF 75-85% and MVV values in below 5 years as compared to above 5 years.

In the present study we found that all the lung volumes were 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.

Our findings suggest that exposure to petrol vapour 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<sup>4</sup>, Singhal M et al<sup>5</sup>

Automobile exhaust, petrol and diesel fuel vapour contain several harmful substances like oxides of nitrogen, sulphur dioxide, carbon monoxide, carbon dioxide, hydrocarbons, unburned carbon particles (soot), benzene. 50% of ambient particulate matter with diameter < 10 Micro Meters (PM<sub>10</sub>) is contributed by exhaust of diesel engines. These small particles are easily inhaled and deposit in the lungs. Organic compounds like polycyclic aromatic hydrocarbons adhere to these particles and are carried deep into the lungs.<sup>4,5,6</sup>

Exposure to diesel exhaust and other pollutants leads to respiratory symptoms and derangement in lung function. These changes are mainly due to increase in airway resistance and inflammatory changes in lungs due to exposure to diesel exhaust and petrol vapour fumes. Li XY et al reported neutrophil influx into lungs and increase in broncho alveolar lavage fluid concentrations of tumor necrosis factor  $\alpha$  in rats following intratracheal instillation of ultrafine carbon particles.<sup>9</sup>

Benzene present in petrol fumes can also be absorbed in the lungs by inhalation.<sup>7</sup> Benzene content in petrol is in the range of 1-5%. Benzene is an exaggerating cause for lung function derangements in petrol pump workers.<sup>8</sup>

Particulate matter of size between 2.5 $\mu$ m and 10 $\mu$ m and NO<sub>2</sub> have been strongly associated with decreased FVC. These particles remain airborne for a long period and get deposited deeper in small airways of lungs.<sup>9</sup> Reduced FVC and FEV<sub>1</sub> have been reported in tunnel and bridge workers and also traffic police.<sup>10</sup> Reduced FEF 25-75% value is considered a good indicator of early small airway disease.<sup>14</sup> Also pollutants from vehicular exhaust and fuel vapours may alter the properties of surfactant which may also contribute to early closure of small airways.<sup>12</sup> Our findings suggest restrictive pattern of

pulmonary involvement in petrol pump workers due to chronic exposure to automobile exhaust and fuel vapours. Also our study showed a direct relationship between duration of exposure and pulmonary function impairment. An exposure of more than 5 years to pollutants in petrol pump workers led to greater pulmonary function impairment as compared to workers who were employed for less than 5 years. Similar findings were reported by Uzma N et al<sup>15</sup>, Aprajita et al<sup>3</sup>, Dube S et al<sup>16</sup>.

## CONCLUSION

Petrol pump workers are continuously exposed to fuel vapours and automobile exhaust. The average duration of daily exposure is about 8 hrs/day. These pollutants affect even other organs in the body. In order to prevent lung damage in petrol pump workers awareness programmes should be conducted and also pre employment check up and periodic medical checkups which include pulmonary function tests should be conducted to detect any lung function impairment at the earliest. Use of protective masks can also reduce exposure to pollutants. Control strategies to reduce benzene concentration in air emission, improvement in engine design, soot filters and fuel modification such as use of biodiesel can also go a long way in reducing exposure hazards. Study group who have lung function impairment during the study were advised to practise yoga exercises related lung functions like pranayama, sukhāsana

**Conflicts of interest:** None

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