

## A COMPARATIVE EVALUATION OF RESPIRATORY INDICES IN PETROL STATION WORKERS OF AGARTALA.

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**ABSTRACT:** The study was conducted on 32 nonsmoker healthy petrol pump workers within 20-50 years age group working in different petrol stations of Agartala with 32 age and sex matched healthy controls from general population. Pulmonary function test parameters FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC (%), PEFR & FEF<sub>25-75%</sub> were recorded by electronic Spirometer using Helios 401 software. There was a statistically significant decrease in all the pulmonary function test parameters in petrol pump workers when compared with the age and sex matched healthy controls. This decline in respiratory indices of petrol pump workers can be due to the inflammatory reactions on airways by the petrol and diesel particles or by mechanical occlusion of the airways by accumulation for longer periods. Preventive measures like pre-employment checkup, use of safety oro-nasal masks, periodic medical checkup, set up standard air quality control, proper vapour recovery system from petrol stations etc. can be employed to secure their health.

**Keywords:** Petrol pump workers; Respiratory indices; FVC; FEV<sub>1</sub>; PEFR, FEF.

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### Introduction:

Petrol is a mixture of volatile hydrocarbons, while diesel is a distillate of petroleum which contains paraffin, alkenes and aromatics.<sup>1</sup> Petrol and diesel exhaust, in addition to generating pollutants like hydrocarbons, oxides of nitrogen and carbon is a major contributor to particulate matter in most places of the world.<sup>2</sup> These two petro products have become an essential commodity for today's speedy life. To mitigate this need there is alarming increase in fuel consumption, increased inhalation of occupational solvents into the human body and a resultant hike in the incidence of health hazards that have been increasingly observed in the recent days.<sup>3</sup> Petrol-pump attendants are the persons who serve the fuel to engine to maintain our speedy life but in many places they do not wear personal protective equipment and personal hygiene is also variable in their workplace. Long term exposure to petrol vapours has shown to affect the different physiological systems in the body, with the highest impact on the respiratory system.<sup>4</sup> Studies on pulmonary function tests of petrol pump workers reveals restrictive pattern<sup>5,6</sup> and mixed pattern<sup>7,8</sup> of lung disease which also depends on duration of exposure mostly significant decline when exposure >5 yrs.<sup>6,8</sup> Although there are national and international reports regarding this but in spite of our best effort hardly, any similar study could be found (which was carried out) specially in this part of the country. Hence, the

present study is undertaken to justify the toxic effects of petroleum in pulmonary functions of petrol-pump workers of Agartala.

### Materials & Methods:

In this cross-sectional study pulmonary function of 32 male and female non-smoker petrol pump workers within 20-50 years of age working for >1 year in different petrol pumps of Agartala is compared with 32 age and sex matched healthy subjects from general population. Those who were not in direct exposure of petroleum fumes such as cleaner, representative of customer service and people involved in lubricants of vehicles excluded from study. Subjects with history of smoking; any respiratory disease like tuberculosis, bronchial asthma, COPD; any chronic disease like diabetes mellitus, hypertension; history of regular medication intake like sedative or hypnotics; major abdominal or thoracic surgery in past were excluded from the study.

This study was conducted in the Department of Physiology, AGMC & GBPH, Agartala and the ethical approval was taken from IEC, AGMC & GBPH.

Sample size was calculated using G-power 3.1 software and a-priori two tailed independent t-test was used with probability of alpha error 5% and beta error 5%; allocation ratio at 1. Effect size was calculated from mean and standard deviation of FEF<sub>25-75%</sub> parameter.<sup>2</sup>

After obtaining the informed consent, the randomly selected subjects (petrol pump workers in Agartala) were approached and the nature and purpose of the study was explained. Basic anthropometric measurements like height, weight etc. were recorded. Using electronic Spirometer Helios 401 software following parameters were recorded: FVC (Forced vital capacity), FEV<sub>1</sub> (Forced expiratory volume in first second), FEV<sub>1</sub>/FVC (%), PEFR (Peak expiratory flow rate), FEF<sub>25-75%</sub> (Forced expiratory flow 25-75%). All the subjects were made familiar with the instrument and the procedure for performing the test. The subject was made to sit and relax for minimum 5 minutes prior to performing the procedure. The procedure was thoroughly explained to each subject stressing on the need to maintain an effective seal with the lips around the mouth-piece and also the use of nose clip during the procedure. Then, the subject was asked to take full inspiration which was followed by as much rapid and forceful expiration as possible in the

mouthpiece. The apparatus provided a detailed analysis of predicted and derived values. The pulmonary function tests were repeated thrice on each occasion for each subject and the maximum reading was selected for analysis as per guidelines of American Thoracic Society.

Data analyzed with SPSS (version 17) and results were expressed as mean  $\pm$  standard deviation (SD) and statistical significance of difference between the groups were assessed by Independent Sample 't' test. P value of <0.05 was considered significant.

#### Observation & Results:

Total participants in this study were 64 (32 petrol pump workers + 32 controls). In both groups among the total 32 candidates 28 were male and 4 females. Mean age, height and weight of study group was 32.59 yrs, 162.78 cm and 61.71 Kg respectively and in control group it was 29.81 yrs, 164.31 cm and 64.59 Kg respectively which did not differ significantly (P>0.05 in all).

Parameter	Group	Mean	Std. Deviation	Std. Error Mean	p value
FVC (L/sec)	STUDY GROUP	3.0700	0.55866	0.09876	<b>0.012**</b>
	CONTROL	3.4184	0.52375	0.09259	
FEV <sub>1</sub> (L/sec)	STUDY GROUP	2.5353	0.48561	0.08584	<b>0.000**</b>
	CONTROL	3.1353	0.54440	0.09624	
FEV <sub>1</sub> /FVC (%)	STUDY GROUP	82.8203	6.08575	1.07582	<b>0.000**</b>
	CONTROL	91.5528	8.09826	1.43158	
PEFR (L/sec)	STUDY GROUP	7.4241	1.38160	0.24423	<b>0.018**</b>
	CONTROL	8.2703	1.39660	0.24689	
FEF <sub>25-75%</sub> (L/sec)	STUDY GROUP	3.1297	0.75136	0.13282	<b>0.012**</b>
	CONTROL	4.4503	0.96893	0.17128	

As shown in Table 1, mean FVC (L/sec) in study group was 3.07 and in the control group was 3.41. There was significant (P=0.012) decrease in the FVC in the petrol pump workers in comparison with control group. Mean FEV<sub>1</sub> (L/sec) in study group was 2.53 and in the control group was 3.13 and the difference was highly significant (P=0.00). Mean FEV<sub>1</sub>/FVC (%) in study group was 82.82 and

in the control group was 91.55, that difference was also highly significant (P=0.00). Mean PEFR (L/sec) in study group was 7.42 and in the control group was 8.27 and the difference was significant (P=0.018). There was also significant (P=0.012) decrease in mean FEF<sub>25-75%</sub> (L/sec) in the petrol pump workers (3.13) in comparison with healthy subjects (4.45).

**Discussion:**

In this study, comparison of five pulmonary functions test parameters (FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC (%), PEFR, FEF<sub>25-75%</sub>) were done with the observations of different journals published in India and abroad. In the below mentioned paragraphs we have discussed different parameters (Respiratory Indices) separately.

**A] FVC (L/sec):** In this study, there was significant (P=0.012) decrease in the mean FVC (L/sec) in the petrol pump workers (3.07) in comparison with control group (3.41). Batta M et al (2015) in Punjab revealed similar finding like this study where mean±SD of FVC (L/sec) decreased significantly (p< 0.001) in petrol pump workers (2.88 ± 0.27) in comparison to age and sex matched healthy controls (3.77 ± 0.33).<sup>9</sup> Solanki B R et al found FVC decreased <80% of predicted in 32% of cases.<sup>21</sup> Studies by Begum S et al,<sup>5</sup> Dube S et al,<sup>20</sup> Choudhari P S et al,<sup>18</sup> Chidri V S et al,<sup>19</sup> Alyami R,<sup>12</sup> Sharma H et al,<sup>14</sup> Sharma N et al,<sup>11</sup> Priyadarshini G et al<sup>7</sup> are in accordance with our study. In contrary, Anuja A V et al (2014) in Chennai found that mean ± SD of FVC (L/sec) in exposed group and unexposed group was 2.77±0.843 and 3.03±0.493 respectively but the difference was not statistically significant.<sup>4</sup> Meo A S et al (2015) concluded that there was non-significant (p=0.083) decrease in mean±SD of FVC (L/sec) in petrol refinery workers (4.76±0.20) in comparison to age and sex matched healthy controls (5.21±0.15).<sup>15</sup> Bhide A et al (2014) found mean and SD values of FVC >5 years exposure group was 2.00±0.87 and <5 years exposure group was 2.39±0.93 and that of the controls was 3.42±0.62, but the difference was statistically non-significant.<sup>17</sup>

**B] FEV<sub>1</sub> (L/sec):** In this study, there was highly significant (P=0.00) decrease in the FEV<sub>1</sub> (L/sec) in the petrol pump workers (2.53) in comparison with control group (3.13). Dube S et al (2013) found that FEV<sub>1</sub> (L/sec) mean and SD values of petrol pump workers (2.47±0.61) are significantly (p<0.01) lower than control group (3.29±0.57).<sup>20</sup> Singhal M et al,<sup>2</sup> Choudhari P S et al,<sup>18</sup> Meo A S et al,<sup>15</sup> Sharma H et al,<sup>14</sup> Chidri V S et al,<sup>19</sup> Alyami R,<sup>12</sup> Begum S et al,<sup>5</sup> Anuja A V et al<sup>4</sup> were also reported similarly. Sinha A et al (2014) found that mean ±SD of FEV<sub>1</sub> (L/sec) was less in direct exposure group compared to that in indirect group; but this difference was not statistically significant. There

was reduction in mean value of FEV<sub>1</sub> in study groups (direct & indirect) than in control one, but the difference was not significant (p>0.05).<sup>13</sup>

**C] FEV<sub>1</sub>/FVC (%):** In this study, there was highly significant (P=0.00) decrease in the FEV<sub>1</sub>/FVC (%) in the petrol pump workers (82.82%) in comparison with control group (91.55%). Similar observation reported by Meo A S et al (2015) who concluded that there was significant (p=0.013) decrease in mean ±SD of FEV<sub>1</sub>/FVC (%) in petrol refinery workers (67.19±3.15) in comparison to age and sex matched healthy controls (76.66±2.01).<sup>15</sup> Other studies in consonance with present study done by Singhal M et al<sup>2</sup> and Alam R et al.<sup>16</sup> In contrary, Sharma H et al (2015) reported non-significant (p=0.145) decrease in mean±SD of FEV<sub>1</sub>/FVC (%) in petrol pump workers (86.11±12.32) in comparison to age and sex matched healthy controls (91.34±8.34) which is not alike present study finding.<sup>14</sup> Begum S et al also found non significant difference.<sup>5</sup> Sinha A et al (2014) found that mean ±SD of FEV<sub>1</sub>/FVC (%) in petrol pump workers directly exposed to fumes, not directly exposed to fumes and controls were 90.45 ± 0.61, 90.74±5.60 and 88.67±6.38 respectively but there was no significant difference in various groups.<sup>13</sup>

**D] PEFR (L/sec):**

In this study, there was significant (P=0.018) decrease in the PEFR (L/sec) in the petrol pump workers (7.42) in comparison with control group (8.27). Singhal M et al (2007) found that PEFR (L/sec) mean ± SD value in petrol pump workers and healthy subjects were 5.41±1.79 and 7.25±1.55 respectively and the difference was statistically significant which is in conformity with present study.<sup>2</sup> Similar observation were found by Meo A S et al,<sup>15</sup> Dube S et al,<sup>20</sup> Anuja A V et al,<sup>4</sup> Alam R et al<sup>16</sup> and Batta M et al.,<sup>9</sup> Sinha A et al (2014) found that mean ±SD of PEFR (L/sec) was significantly reduced in direct group (p<0.0001) and indirect group (p<0.05) compared to control group.<sup>13</sup> In contrary, Begum S et al (2012) in Karnataka found that mean ±SD of PEFR (L/sec) decreased in petrol pump workers (7.47±1.40) in comparison to age and sex matched healthy controls (8.05±1.59) but was statistically not significant (p= 0.145).<sup>5</sup>

**E] FEF<sub>25-75%</sub> (L/sec):**

In this study, there was highly significant ( $P=0.012$ ) decrease in the  $FEF_{25-75\%}$  (L/sec) in the petrol pump workers (3.13) in comparison with control group (4.45). Choudhari P S et al (2013) evaluated pulmonary function of petrol pump workers and found similarly that  $FEF_{25-75\%}$  mean and SD values for study group ( $71.6\pm 18.3$ ) decreased significantly ( $p=0.0001$ ) in comparison to control group ( $85.5\pm 12.4$ ).<sup>18</sup> This is in accordance with Singhal M et al<sup>2</sup> and Batta M et al.<sup>9</sup> Bhide A et al (2014) found mean and SD values of  $FEF_{25-75\%}$  for the >5 years exposure group was  $3.15\pm 1.17$  and for the <5 years exposure group was  $3.31\pm 1.02$  and for controls it was  $3.94\pm 1.13$  and the differences was statistically significant.<sup>17</sup> In contrast to our study, Sinha A et al (2014) found reduction in  $FEF_{25-75\%}$  in petrol pump workers but the difference was not statistically significant.<sup>13</sup>

**Conclusion:**

In the present study there was a statistically significant decrease in all respiratory indices (FVC,  $FEV_1$ ,  $FEV_1/FVC$  (%), PEFR &  $FEF_{25-75\%}$ ) in petrol pump workers in comparison to age and sex matched healthy subjects. The results obtained are in consonance with the other Indian and foreign authors. This study enlightens us about the occupational hazards of petrol station workers on their health especially over lung. So, this study specially focuses for selection of petrol pump workers by pulmonary function measurements as pre-employment checkup, to measure the degree of lung function derangement and the progress of pre-existing lung disease among the petrol pump workers. Preventive measures like use of safety oro-nasal masks, periodic medical checkup, set up standard air quality control, proper vapour recovery system from petrol stations etc. can be adopted and the benefits of these can be explained by a research work involving larger number of petrol pump workers.

**Disclosure of Interests:**

We claim no potential conflicts of interest exist with any company/organizations whose products or services may be discussed in this article. Furthermore, we claim no personal, political, intellectual or religious interests that conflict with our interests.

**Ethical Clearance:**

Ethical Clearance was taken from Institutional Ethics Committee (IEC) for Clinical studies, Agartala Govt. Medical College, Agartala, Tripura.

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