

Lung Function Test in Petrol Pump Workers

Sandip M Hulke¹, Prashant M Patil¹, Avinash E Thakare¹, Yuganti P Vaidya²

¹ L.N. Medical College and Research Centre, Bhopal

² Mahatma Gandhi Institute of Medical Sciences, Sevagram

Correspondence to:

Sandip M Hulke

(smh555@rediffmail.com)

Received: 15.11.2011

Accepted: 02.12.2011

ABSTRACT

Background: Occupational exposure of petroleum product and its exhaust are causing significant health problem in petrol pump workers. The present study was planned to assess the lung function according to the duration of occupational exposure in petrol pump workers.

Aims: To assess the lung function according to the duration of occupational exposure in petrol pump workers.

Materials and methods: This was a cross sectional study done on the 119 petrol pump workers, who were involved in filling the petrol or diesel. Hundred and nineteen petrol pump workers were divided into four groups depending on the duration of exposure; their pulmonary function test was done and was compared with 33 healthy nonsmokers.

Results: Significant reduction was seen in the FEV1 (Forced expiratory volume in 1 sec), FVC (forced vital capacity) in petrol pump workers who were exposed to more than 5 years. Flow rates i.e. FEF 25-75%, PEFR and PIFR also decreased significantly in the workers exposed more than 10 years.

Conclusion: Petrol pump workers are vulnerable to develop restrictive lung disease especially those who are involved in the occupation for long duration (more than 5 years).

KEY WORDS: Petrol pump workers, FEV1, FVC, PEFR

INTRODUCTION

It is a well-documented fact that the polluted air causes ill effect on the health. Many studies have been done which shows the effect of polluted environment on the respiratory tract.^[1,2] Health problems posed by the pollutants are closely linked to the nature and level of exposure to hazardous pollutants. In the same way, urban life and its vehicular density are contributing to it. Petroleum product and its exhaust are causing significant health problem symptoms like chronic cough, breathlessness and wheezing.^[3,4] In high concentration they cause marked systemic pulmonary inflammatory response. Occupational exposure of such product cause impairment of functions of various parts of the body.^[5] Animals exposed to diesel exhaust was also shown to develop altered lung function.^[6,7]

Petrol pump workers (filling attendants) are continuously exposed to the organic and inorganic substances present in the petrol. Their average daily exposure exceeds about 10h/day. Duration of exposure may vary depending on their occupation tenure. Hence this study was planned to assess the lung function according to the duration of occupational exposure in petrol pump workers.

MATERIALS AND METHODS

Present study was done on 152 participant who were healthy and non-smoker. A total of 119 participants were selected from various petrol pumps in the city of Bhopal, and they were divided into four study groups depending on their duration of exposure. Then they were compared with age matched healthy male non-smokers (control group). Control group was taken from paramedical staff of laxminarayan medical college, Bhopal.

History, examination and lung function test was done during visit to the petrol pump. An informed written consent was taken after explaining the procedure to the subjects. History was asked about any cardiac or respiratory disease and regarding total duration of

occupation. Examination was done and then pulmonary function test was performed.

Exclusion criteria

- Smokers
- H/o chronic respiratory disease
- H/o cardiac disease
- Examination finding suggestive of respiratory or cardiac disease
- Body mass index more than 30

For pulmonary function test, MIR Spirolab II (Via Del Maggiolino, 125, 00153, Rome, Italy) was used. Pulmonary function test was recorded at the visit to petrol pump around morning 9 am. PFT of the control group was done in the PFT lab of Laxminarayan Medical College.

All the subjects were made familiar with the instrument and the procedure for performing the test. The data of the subject as regards to name, age, height, weight, sex, date of performing the test, atmospheric temperature was fed to the computerized MIR Spirolab.

The tests were performed in sitting position. The subject was asked to take full inspiration which was followed by as much rapid and forceful expiration as possible in the mouthpiece of MIR Spirolab. Three consecutive readings were taken and the best reading amongst the three was selected. We followed the guidelines of American Thoracic Society.^[8]

Lung function parameters studied were forced vital capacity (FVC), Forced expiratory volume in 1 sec (FEV1), FEV1 as percentage of FVC in % (FEV1 (%)), Peak expiratory flow rate in liters/sec (PEFR), Peak inspiratory flow rate in liters/sec (PIFR) Forced expiratory flow rate in liters/sec in 25% of FVC (FEF25%), Forced expiratory flow rate in liters/sec in 50% of FVC (FEF50%), Forced expiratory flow rate in liters/sec in 75% of FVC (FEF75%), Forced expiratory flow rate during 25 to 75% of expiration (FEF25-75%), maximum voluntary ventilation (MVV).

Then the data of the observation for all parameters were statistically analyzed by calculating mean and standard deviation. The data was analyzed using Graph pad prism5 software. These readings were compared using one way ANOVA and Bonferroni's post-test and P values < 0.05 were taken as significant.

Approval for the study was taken from institution ethics committee.

RESULTS

There were total five groups. Five groups were made depending upon the duration of occupation. These groups were control group (not exposed) [Male (n=33, age ± S.D. 38.12±7.16 yrs)], exposed for 0-1 year [Male (n=29, age ± S.D. 39.15±8.18 yrs)], exposed for 1-5 year [Male (n=29 , age ± S.D. 38.16±8.14 yrs)], exposed for 5-10 year [Male (n= 30, age ± S.D. 40.12±6.16 yrs)], exposed for more than 10 years [Male(n=31 , age ± S.D. 39.99±7.66 yrs)].

Figure-1: Anthropometric parameters males

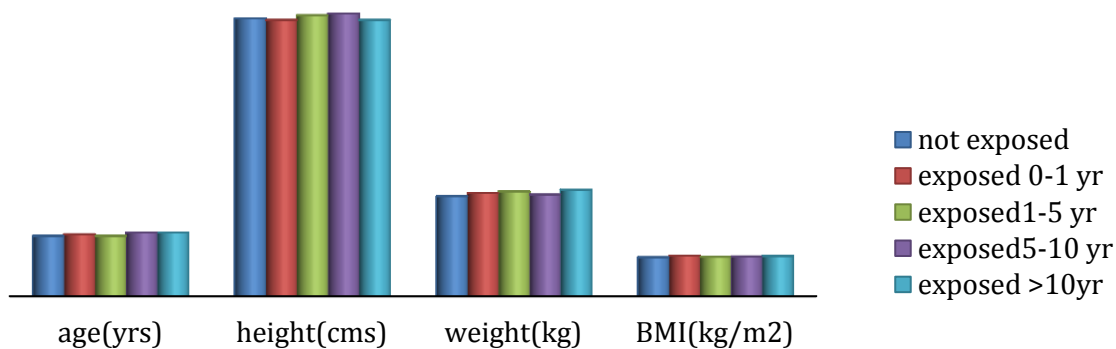


Table-1: Anthropometric parameters

PARAMETERS	Not exposed (33)	Exposed For 0 to 1 year (29)	Exposed For 1 to 5 year (29)	Exposed For 5 to 10 year(30)	Exposed For more than 10 year(31)
Age (yrs)	38.12±7.16	39.15±8.18	38.16±8.14	40.12±6.16	39.99±7.66
Height (cms)	166.45±11.15	168.14±10.14	165.45±11.45	168.14±10.13	167.45±11.35
Weight (kg)	69.14±9.14	70.11±10.57	71.13±9.88	71.11±10.44	69.98±9.43
BMI (kg/m²)	23.13± 2.38	24.59± 2.24	23.61± 2.41	23.99± 2.33	24.13± 2.58

Table-2: Lung function parameter in petrol pump workers according to the duration of exposure

PARAMETERS	Not exposed (n=33)	Exposed For 0 to 1 year (n=29)	Exposed For 1 to 5 year (n=29)	Exposed For 5 to 10 year (n=30)	Exposed For more than 10 year (n=31)
FVC(L)	4.120±0.56	4.118±0.53	3.980±0.50	3.840*±0.56	3.810**#±0.55
FEV1(L)	3.548±0.54	3.677±0.64	3.422±0.63	3.340*±0.51	3.33*±0.59
FEV1 (%)	86.780±5.54	85.58±5.14	84.580±4.98	83.450±5.15	84.14±4.99
PEFR (L/SEC)	8.150±1.34	7.880±1.335	7.780±1.322	7.340±1.314	7.11*±1.33
PIFR (L/SEC)	3.121±1.11	3.22±1.23	3.11±0.94	3.01±0.81	2.88±0.75
FEF - 25-75%	4.291±1.01	4.150±0.94	4.050±0.98	3.980±1.11	3.91*±1.08
FEF - 25%	6.568±2.34	6.450±2.14	6.120±1.89	6.080±1.9	5.598±2.44
FEF - 50%	5.840±1.04	5.490±1.33	5.510±1.34	5.480±1.41	5.51±1.25
FEF - 75%	3.125±1.01	3.444±1.1	3.460±0.84	3.451±0.91	3.120±0.86
MVV	133.250±25.54	133.250±23.34	131.120±22.54	130.250±23.54	132.580±26.54
Duration/exposure	0	6 m±1.13	3.57 yr±2.133	8.184 yrs±3.68	17.45 yr± 3.66

*:= p<0.05,**:= p<0.01 significant change (comparison between not exposed and other group)

#:= p<0.05 significant change (comparison between exposed{0 to 1 yr} and other group)

Anthropometric parameter of the subjects is shown in the figure 1 and table 1. All five groups were matched in all anthropometric parameters. Five groups didn't differ significantly in these parameters. Their average daily exposure was about 10h/day.

Lung function parameters along with their mean duration of exposure are shown in table 2. FVC was significantly decreased in the petrol pump workers with the history of exposure more than 5 years. It further deteriorated with increased duration i.e. more than 10 years. Another parameter which also showed a significant decrease with more than 5 years is FEV1. FEF25-75%, PEFR and PIFR also decreased significantly in the workers exposed more than 10 years. No significant change was seen in the other parameters which were studied.

DISCUSSION

In the present study, significant reduction was seen in the FEV1 (Forced expiratory volume in 1 sec), FVC (forced vital capacity) in petrol pump workers who were exposed to more than 5 years. Flow rates i.e. FEF-25-75%, PEFR and PIFR also decreased significantly in the workers exposed more than 10 years. However in this study, FEV1 (%) showed non-significant change, thus suggesting restrictive type of lung disease.

Previously studies have been performed in petrol pump workers and petrol filling workers.^[3,4,5,9] In these studies, lung function impairment was seen. In a study done in petrol pump workers, restrictive type of lung disease was seen, as in ours.^[3,4] In a study by Meo SA et al^[10], in the subjects exposed to crude oil spill into sea water, significant reduction in forced vital capacity (FVC), forced expiratory volume in first second (FEV(1)), forced expiratory flow (FEF(25-75%)) and maximum voluntary ventilation (MVV), however this impairment was reversible and lung functions parameters were improved when the subjects were withdrawn from the polluted air environment. Similar findings were observed in cats following long-term exposure to diesel exhaust.^[11] However previous work involving

animal exposures to diesel exhaust and pulmonary function tests has shown varying results.^[6,7] In our study also the lung function impairment was seen in some lung function parameter, however our study was different from other study in the aspect that we had compared our subject according to the duration of occupation and we found significant change in some lung function parameter with exposure of more than 5 years.

In a study by Salvi S et al^[12], in healthy human volunteers who were exposed to air and diluted Diesel Exhaust under controlled conditions for 1 hr with intermittent exercise, marked systemic and pulmonary inflammatory response was seen but lung function parameters were normal. So it is possible that lung function derangement may occur at much later stage as in our study. What may be the different causes of lung function derangement? It may be because of pulmonary inflammatory response as a result of diluted diesel exhaust over the long duration. These diluted exhausts may contain toxic compound like hydrocarbons and metal like lead. Petrol pump workers are exposed to these toxic compounds for longer duration. These particles may be responsible for structural damage and impaired lung function.^[13,14] Particles generated from diesel exhaust are extremely small and are present in the nuclei or accumulation modes, with diameters of 0.02 nm and 0.2 nm respectively.^[15] These small sized particles, by virtue of their greater surface area to mass ratio, can carry a much larger fraction of toxic compounds, such as hydrocarbons and metals on their surface which may further impair lung function. 15 Petrol pumps are situated on the busy roads so the air pollutant may further contribute to lung function impairment.⁴ Our results were suggestive of restrictive type of lung disease. In our study, forced expiratory flow (FEF(25-75%)) also known as the maximum mid expiratory flow rate also showed significant decrease. It is a sensitive indicator of small airway disease where most of the chronic obstructive pulmonary disease starts.^[16]

Limitation of the Study

Most important limitation was that, we could not get the ambient air quality data near the petrol pump from the pollution control board due to which we were not able to know the exact level of suspended particulate mater, respirable suspended particulate mater. It may be within permissible limit or more than permissible limit.

Control group in our study was having sedentary life style. We should have included group whose lifestyle was comparable with that of the petrol pump workers.

CONCLUSION

Petrol pump workers are vulnerable to develop restrictive lung disease with involvement of small airways, especially those who are involved in the occupation for long duration (more than 5 years). We recommend further studies to be performed in different cities to support our findings with larger data, and studies recommending various measures to prevent ill effect of the same in petrol pump workers.

REFERENCES

1. Nakai S, Maeda K, Crest JST. Respiratory health associated with exposure to automobile exhaust. III. Results of a cross sectional study in 1987, and repeated pulmonary function tests from 1987 to 1990. Arch Environ Health 1999; 54: 26–32.
2. Chabra SK, Chabra P, Rajpal S, Gupta RK. Ambient air pollution and chronic respiratory morbidity in Delhi. Arch Environ Health 2001; 56: 58–63.
3. Uzma N, Salar BM, Kumar BS, Aziz N, David MA, Reddy VD. Impact of organic solvents and environmental pollutants on the physiological function in petrol filling workers. Int J Environ Res Public Health 2008 ;5:139-46.
4. Singhal M, Khaliq F, Singhal S, Tandon OP. Pulmonary functions in petrol pump workers: a preliminary study. Indian J Physiol Pharmacol 2007;51:244-8.
5. Das M, Bhargava SK, Kumar A, Khan A, Bharti RS, Pangtey BS, Rao GS, Pandya KP. Ann Occup Hyg. An investigation of environmental impact on health of workers at retail petrol pumps 1991;35:347-52.
6. Vinegar A, Carson A, Pepelko WE. Pulmonary function changes in Chinese hamsters exposed six months to diesel exhaust. Env Internal 1981; 5: 369–71.
7. Mauderly. Life-span of rodents inhaling diesel exhaust: results through 30 months. Inhal Toxicol Res Inst Ann Rep 1983; 305–16.
8. American Thoracic Society. Standardization of spirometry, 1987 up-date. Am Rev Respir Dis 1987;136:1285-98.
9. Verma Y, Rana SV. Biological monitoring of exposure to benzene in petrol pump workers and dry cleaners.Ind Health. 2001 Oct;39(4):330-3.
10. Meo SA, Al-Drees AM, Meo IM, Al-Saadi MM, Azeem MA. Lung function in subjects exposed to crude oil spill into sea water. Mar Pollut Bull 2008;56:88-94.
11. Moorman WJ, Clark JC, Pepelko WE, Mattox J. Pulmonary function responses in cats following long-term exposure to diesel exhaust. J Appl Toxicol 1985; 5: 301–305.
12. Salvi S, Blomberg A, Rudell B, Kelly F, Sandström T, Holgate ST, et al. Acute inflammatory responses in the airways and peripheral blood after short-term exposure to diesel exhaust in healthy human volunteers. Am J Respir Crit Care Med. 1999 ;159:702-9.
13. Fortoul TI, Osorio LS, Tovar AT, Salazar D, Castella ME and Olaiz-Fernandez G. Metals in lung tissue from autopsy cases in Mexico city residents : Comparison of cases from the 1950's and the 1980's. Environmental Health Perspectives 1996; 104: 630–32.
14. Lippman MB. Lead and human health: Background and recent findings. Environ Res 1990; 51: 1–24.
15. Levsen K. The analysis of diesel particulate. Fresenius Z Anal Chem 1988; 331: 467–478.
16. Jain AK. Mechanism of respiration. In Jain AK (ed.).Textbook of physiology, 3rd edition. Avichal publishing company, New Delhi,2008;431-456.

Source of Support: Nil
Conflict of interest: None declared