ORIGINAL ARTICLE

Ventilatory Impairment In Petrol Pump Workers

Neena Sharma, Neeru Gupta, Ritu Gupta

Abstract

The lung functions of 133 subjects (33 controls and 100 petrol pump workers) were studied. The study group comprised of healthy non-smoking males in the age group of 20-40 years working in different petrol pumps in Jammu city and its outskirts within a radius of 10 km for more than one year. The control group comprised of 33 healthy non-smoking adult males between the age group of 20-40 years working in the hospital. The results show that ventilatory efficiency of lung is decreased in petrol pump workers. The decline in lung functions in petrol pump workers could be due to exposure to petrol fuel vapours, diesel exhaust and airborne particulate matter at petrol pumps.

Key Words

Ventilatory Lung Function, Petrol Pump Workers, Benzene

Introduction

Lung function tests have been of increasing interest in the use for qualitative and quantitative evaluation of pulmonary function in patients with abnormalities of cardiorespiratory system (1).

Petroleum refining products are constituted by cycloalkanes, straight and branched chain alkenes which are continued source of pollution in various occupational settings (2). With the increasing use of petroleum and petroleum products, there is greater opportunity for human ingestion and addiction of these toxic substances (3). Benzene and toluene are major monocyclic hydrocarbons in petrol with nitropyrene in diesel exhaust emission (2). Benzene is a highly volatile and the most usual route of exposure is through inhalation of vapour (4). In India, the percentage of benzene in automobile gasoline is only about 3% whereas in other countries it may be as high as 30%. Therefore, petrol pump workers are very likely to be exposed to the toxic effects of benzene in petrol (5). A small percentage of benzene can be detected in the expired air after being absorbed through the lungs (6). Studies on health condition in petrol pump workers have concentrated more on clinical symptoms with limited reports on lung function. The present study is carried out to assess the dynamic ventilatory lung function in petrol pump workers so as to comment on the long-term effects of work environment on lung function.

Material And Methods

The present study was conducted on 133 male subjects - 33 control and 100 petrol pump workers. The study group comprised of healthy non-smoking males in the age group of 20-40 years working in different petrol pumps in Jammu City and its outskirts for more than a year. The control group comprised of 33 healthy non-smoking adult males between the age group of 20 to 40 years working in the GMC & hospital as nursing orderlies, medical assistants and other hospital personnel. The

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Table 1. Showing Physical Parameters of Control Subjects and Petrol Pump Workers

Study Group	Age in years (Mean ± SD)	Weight in kg (Mean ± SD)	Height in cm (Mean ± SD)	Body surface area m^2 (Mean ± SD)
Control (33)	32.88 ± 5.30	64.44 ± 12.22	170.12 ± 6.16	1.79 ± 0.16
Petrol pump workers (100)	32.37 ± 5.09	61.61 ± 8.86	165.89 ± 6.47	1.69 ± 0.14

Number in parenthesis indicates the number of subjects

Table 2. Showing Mean Values and SD of Various Flow Rates In Control Subjects and Petrol Pump Workers

PFT	Control (33) Mean ± SD	Petrol pump workers (100) Mean ± SD
FVC (liter)	3.12 ± 0.30	2.52 ± 0.68**
FEV_1 (liter)	2.86 ± 0.21	2.20 ± 0.81*
MVV (liter/minute)	117.38 ± 26.98	90.09 ± 32.88**
PEFR (liter/second)	8.55 ± 1.80	6.44 ± 1.84**

*PFT = pulmonary function test; Number in parenthesis indicates the number of subjects; ** = highly significant; * = significant*

Table 3. Showing the Mean Values of PFT In Urban and Rural Subjects

PFT	Urban subjects (56)	Rural subjects (44)	Statistical inference
FVC (liter)	2.32 ± 0.82	2.77 ± 0.32	p = .0003**
FEV_1 (liter)	2.07 ± 0.87	2.38 ± 0.68	p = .04*
MVV (liter/minute)	80.64 ± 32.12	91.93 ± 34.11	p = .003**
PEFR (liter/second)	5.84 ± 1.81	6.63 ± 1.88	p = .03*

Table 4. Mean Value of P. Function Test In Petrol Pump Workers According to Duration of Exposure

PFT	Group I (52)	Group II (36)	Group III (12)	Statistical inference
FVC (liter)	2.77 ± 0.57	2.34 ± 0.61	2.16 ± 1.02	p = .006**
FEV_1 (liter)	2.53 ± 0.61	1.96 ± 0.60	1.47 ± 1.29	p = .0001**
MVV (liter/minute)	103.98 ± 21.37	87.82 ± 21.81	68.63 ± 17.34	P = .0001**
PEFR (liter/second)	7.21 ± 1.79	5.74 ± 1.57	5.21 ± 1.25	p = .0001**

*Number in parenthesis indicates the number of subjects; Group I = exposure <5 years; Group II = exposure 6 to 10 years; Group III = exposure 11 to 15 years; ** = highly significant*

subjects were selected after taking a detailed history and thorough clinical examination. Subjects with the history of smoking, drug addiction, abdominal and chest surgery and cardiorespiratory illness were excluded from the study. The physical parameters noted for each subject were age in years, height in centimeters, weight in kilograms and body surface area in square meters (Toshniwal-Du Bois Nomogram).

The various lung function tests recorded were:-

1. Forced vital capacity (FVC).
2. Forced expiratory volume in 1st second (FEV1).
3. Maximum voluntary ventilation (MVV).

4. Peak expiratory flow rate (PEFR).

The pulmonary function tests were recorded by Medspiror (Records and Medicare System). These readings were taken at the same time of the day in sitting position and best of the three readings was incorporated in the study.

Results

Table 1 shows the physical parameters of the control subjects and petrol pump workers. The mean values of age, height, weight and body surface area were slightly more in control subjects.

In the present study, the mean FVC value in petrol pump workers (*Table 2*) was observed to be less than that of control subjects. The difference in the mean value of FVC among petrol pump workers and controls was highly significant (p = 0.0007).

In the present study, FEV1 was lower in petrol pump workers as compared to control subjects. The difference in the mean FEV1 between the two groups was found to be statistically significant (p = 0.5).

MVV is considered to be good guideline of the mechanical efficiency of the lungs. It measures the status of respiratory muscles, compliance of lungs and resistance offered by airways and tissues. MVV is more liable to practice and fatigue effects (7). In the present study, mean value of MVV was significantly lower in petrol pump workers (p = 0.000).

PEFR is the method of assessing the ventilatory capacity with single breath. In the present study, the mean value of PEFR is 8.55 L/sec for control and 6.44 L/sec for study group. The difference between the mean in the two groups was statistically significant (p = 0.0001).Subgroup analysis of petrol pump workers was done based on place of work into urban petrol pump workers working in petrol pumps in urban area and rural petrol pump workers working in petrol pumps in rural area (*Table 3*). Subgroup analysis based on place of work between urban and rural subjects showed that the difference in the mean value of FVC was statistically significant (p = 0.0003). Subgroup analysis between urban and rural subjects showed that difference in the mean value of FEV1 was statistically significant (p = 0.04). Subgroup analysis between urban and rural subjects reported statistically significant decrease in MVV (p = 0.003) and PEFR (p = 0.03).*Table-4*

Discussion

In the present study, the mean FVC value in petrol pump workers was lower than that of control subjects and the difference in the mean value was statistically significant (p = 0.0007). These findings are in agreement with the observations of Singhal *et al*. (8), Meo *et al*. (9), Kesavachandrani *et al*. (10) and Ayres *et al.* (11).Ayres *et al.* (11) demonstrated that workers exposed to diesel and automative exhaust had increased airway resistance, increasing closing volume and reversible reduction of FVC. In the present study, FEV1 was lower in petrol pump workers as compared to control subjects and the difference in the mean FEV1 between the two groups was statistically significant (p = 0.05). This observation is in agreement with the observations of Kesavachandrani *et al*. (10) and Skyberg *et al.* (12), who reported decline in FEV1 with years of work exposure.

In the present study, mean value of MVV was significantly lower in petrol pump workers (p = 0.000). The difference in the mean values of PEFR among petrol pump workers and control group in the present study was statistically significant (p = 0.0001).

Subgroup analysis based on place of work between urban and rural subjects showed statistically significant decline in FVC (p = 0.0003), FEV1 (p = 0.04), MVV (p = 0.003) and PEFR (p = 0.03).

In the present study, there was progressive decline in lung function with increase in duration of exposure. The progressive decline in FVC and FEV1 with duration of exposure is in compliance with studies conducted by Kesavachandrani *et al*. (10) and Chawla and Lavania

(13).Most of the epidemiologic studies of petrol pump workers disclosed a high prevalence of respiratory symptoms. This study demonstrates that certain physiological dysfunctioning effects are constantly observed in occupationally exposed petrol pump workers. This study indicates that exposure to petrol fuel vapours, diesel exhausts and airborne particulate matter at petrol pumps leads to restrictive type of lung impairment in petrol pump workers as compared to control. The impairment in lung function is associated with dose effect response to duration of exposure to petrol fumes, diesel exhaust, etc. Chronic exposure in petrol pump workers for more than 5-10 years revealed statistically significant decrements in FVC, FEV1, MVV and PEFR (14,15).

The data suggest that background benzene, petrol and diesel exhaust, particulate matter and air pollutants account for substantial ventilation impairment. In order to prevent these among petrol filling workers, we suggest medical observation including pre-employment and periodic medical check-up like pulmonary function tests. Control strategies should be adopted to reduce the benzene concentration in the ambient air and include evaporation control, use of catalytic converters and reducing benzene concentration in fuel. Medical screening and screening of benzene and CO in air may protect workers from developing chronic respiratory disorders. Early recognition and removal of sensitive workers from working place before chronic impairment develops will help. Development of appropriate equipment for monitoring and testing for environmental pollutants in the community and in workers would be beneficial.

Conclusion

Any significant decline in the lung functions with time, merits attention. Since most individuals are likely to remain asymptomatic till significant pulmonary damage results, regular monitoring of lung functions is desirable.

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