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Evaluation of pulmonary function tests in fuel filling workers and construction workers

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Abstract

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. 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.

Materials and Methods: This is a prospective, descriptive and observational study conducted in the Department of Physiology, Index Medical College, Hospital and Research center Indore from Period of study from January 2021 to December 2022. They are 3 groups in our study: Group-I normal health individual-(N=50), Group-II fuel filling workers-(N=50) and Group-III construction workers-(N=50).

Results: In our study, the most of workers age group is 18-30 years i.e., 19 out of 50, followed by 31-40 years, i.e., 17 out of 50 in Group I and in Group II 18-30 years i.e., 18 out of 50, followed by 31-40 years, i.e., 17 out of 50. In Group III 18-30 years i.e., 20 out of 50, followed by 31-40 years, i.e., 12 out of 50. Group I out of 50, 39 subjects were male and 11 were female subjects. In Group II 36 were male and 14 were female subjects. In Group III 39 subjects were male and 11 were female subjects. The Mean Working hours of participants of Group I is 8.10±0.37 and Group II is 8.10±0.37 Group III in 8.10±0.37. All the parameters of Pulmonary Function Test were significantly difference among 3 groups.

Conclusion: The present study adds evidence that cement dust adversely affects the respiratory functions and this impairment is association with duration of exposure to cement dust. It also suggests that the workers must undergo pre-employment and periodic medical examination including lung function test. Thus, this study showed existing changes in pulmonary function related to dust exposure, and generated evidence to integrate primary prevention methods towards dust- related morbidity and mortality.

Keywords: Pulmonary function tests, Fuel filling workers, Construction workers

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. [1] 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. [2]

A long-term exposure to the air pollutant leads to effects of respiratory functions. Air pollutants and chemicals like benzenes, lead, CO2, NO2, CO etc; play a role in the pathogenesis of respiratory diseases. [3] 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 bronchoconstriconstriction. Mucosal irritation and alveolar swelling leads to obstructive and restrictive disorders of lungs. [4]

Work-related disorders are the major cause for complaints and disability in worker populations. The main problem encountered in the environment is the respirable dust. When fine dust enters the respiratory system, the human body considers it to be foreign material which should be defended against. [5] Exposure to ambient particulate air pollution is associated with increase in morbidity and mortality from respiratory and cardiovascular diseases. Individuals working in dusty environment face the risk of inhaling particulate materials that may lead to adverse respiratory effects. [6]

PFT are used to identify the pattern and severity of a physiologic abnormality, but has to be used with other tests to distinguish between the potential causes of the abnormalities. Pulmonary Function Tests involves the measure of airflow rates, lung volumes, and the ability of the lung to transfer gas across the alveolar capillary membrane. Pulmonary function parameters are very useful to diagnose obstructive lung disease. [7]

Pulmonary function is governed by genetic, environmental and nutritional factors and confirms that physical training during growth help in developing a greater endurance in respiratory muscles. Impaired PFTs are associated with increased mortality and morbidity. [8] Physical activity is known to improve physical fitness and to reduce morbidity and mortality from numerous chronic ailments. [9]

Although PFT is genetically regulated and its function is among others influenced by the environmental and alimentary factors, the previous studies have shown that it can be improved by bodily exercise. PFT is also influenced by the type of the sports played. PFT tests provide a qualitative and quantitative evaluation of PFT and are of the highest

importance in estimating the fitness of an individual from a physiological point of view. Spirometry is the most commonly used lung function test in the objective assessment of respiratory system function. [10]

MATERIALS AND METHODS

This is a prospective, descriptive and observational study conducted in the Department of Physiology, Index Medical College, Hospital and Research center Indore from Period of study from January 2021 to December 2022.

Inclusion criteria:

- Age group - 25–50 years.
- Work experience: exposed 3 to 5years.
- Non-smokers.
- Persons willing to give consent.

Exclusion criteria

- Persons not willing to give consent.
- Gross pulmonary disease.
- Anatomical deformity of chest & spine.
- Infective lung disease like tuberculosis.
- Severe respiratory distress.
- Cardiac patients.
- Connective tissue disease.
- Post thoracic surge.

Sample size

- ✓ Group-I normal health individual-(N=50)
- ✓ Group-II fuel filling workers-(N=50)
- ✓ Group-III construction workers-(N=50)

Methodology

Intervention

- Detailed history relevant to the study is taken.
- Informed consent taken from the all participants.
- Patients who are willing and satisfying the inclusion criteria are to be selected as per inclusion criteria participant divided into various groups, Group-1,Group-2, Group-3.
- Informed consent was obtained from all the patients taken up for study.

STUDY PARAMETERS:

1. **Forced vital capacity**
2. **Forced expiratory volume**
3. **FEV1 / FVC RATIO (OR) FEV1%**
4. **FEF 25-75%**

Statistical Analysis

The qualitative and quantitative data values were expressed as frequency along with percentage and mean ± standard deviation (SD). Association between two are more variables was assessed Chi-square test Fisher Exact test as appropriate. Independent sample t-test was used for data with normal distribution and mann-whitney U-test was employed for those without normal distribution. Pictorial presentations of the key results were made using appropriate Statical graph. A $P<0.05$ was considered to be significant. Descriptive statistics was used to summarize demographic and other clinical features of subjects. All statistical analysis were done using Statical packages SPSS 25.0.

Results:

The present study was done in 150 participants (Group I -n=50, Group II n= 50, Group III n=50). In our study, the most of workers age group is 18-30 years i.e., 19 out of 50, followed by 31-40 years, i.e., 17 out of 50 in Group I and in Group II 18-30 years i.e., 18 out of 50, followed by 31-40 years, i.e., 17 out of 50. In Group III 18-30 years i.e., 20 out of 50, followed by 31-40 years, i.e., 12 out of 50.

Table 1: Distribution of different age groups of patients

Age in years	Group I	Group II	Group III
18-30	19	18	20
31-40	17	17	18
41-60	15	15	12
Total	50	50	50

Table 2: Distribution of gender

Gender	Group I	Group II	Group III
Male	39	36	37
Female	11	14	13
Total	50	50	50

In table 2, in Group I out of 50, 39 subjects were male and 11 were female subjects. In Group II 36 were male and 14 were female subjects. In Group III 39 subjects were male and 11 were female subjects.

Table 3: Anthropometric measurements of control group, fuel filling workers and construction workers.

Variables	Group I	Group II	Group III
Age (years)	34.32±4.34	33.71±4.14	36.23±5.2
Height	156±13.2	154±12.2	159.4±11.6
Weight (kg)	57.2±5.8	58.3±5.7	59±5.9
Working hours	8.10±0.37	8.10±0.37	8.10±0.37

The Mean age of participants of Group I is 34.3±4.34 and that of Group II 3 is 33.71±4.14 and Group III is 36.23±5.2 years. Their mean height is 156±13.2 in Group I, 154±12.2 in Group II, 159.4±11.6 in Group III. The Mean weight of participants of Group I is 57.2±5.8,

Group II is 58.3±5.7 and Group III is 59±5.9. The Mean Working hours of participants of Group I is 8.10±0.37 and Group II is 8.10±0.37 Group III in 8.10±0.37 in Table 3.

Table 4: PFT Data of control group, fuel filling workers and construction workers.

Variables	Group I	Group II	Group III
FVC (lit)	3.17±0.37	2.87±0.29	2.17±0.23
FEV1(lit)	2.93±0.33	2.43±0.23	2.03±0.15
FEV1/FVC	92.26±3.33	83.42±2.41	79.26±2.1

In table 4 showed that all the parameters of Pulmonary Function Test were significantly difference among 3 groups.

Discussion:

However, a statistically significant decline was noted only in FVC, FEV1, MVV, TV, FEV1% and PEFR, among the fuel filling workers and construction workers as compared to controls. Our results are similar to studies done by Chandran CK et al. [11]. Singhal et al. found statistically significant decrease in FVC, FEV1, and PEFR in petrol pump workers who were exposed to petrol and diesel fumes [28] were also similar to our study. Similarly, Khurana I et al. also found statistically decrease in FVC, FEV1, PEFR in petrol pump workers which correlates with our study. However, FEV1% is decreased but the decline is not statistically significant [12].

In our study reduced values of FVC and FEV1, PEFR in fuel filling workers suggests exposure to petroleum products leads to restrictive lung disease with obstructive element. Similar findings were noted by Sable M al. in their study the results reported are reduced ERV, FVC and FEV1 suggesting restrictive and obstructive lung diseases [13]. The decline in observed values of VC, FVC, FEV1 among petrol pump workers indicating restrictive type of lung disease was also observed by Akhade VV et al. [14]

Bamne SN et al conducted a study to find out association between dust exposure and airway inflammation and found lower airway inflammation even though they worked for only 1 year. The results of the present study also showed a decreased FEV1 which is in agreement with the observations made by these authors. [15] Upadhyaya D *et al.*, found significant lower FEV1/FVC ratio in their study in workers which also comparable with our study showing significant lower FEV1/FVC (71.42±2.41 study group Versus 62.26±3.1healthy group) ratio [16].

The hexavalent chromium content of cement has been implicated as the etiology of allergic occupational pulmonary impairment. [17] Joshi LN et al carried out a study which showed that cement dust adversely affects the respiratory function and this impairment is associated with duration of exposure to cement dust. [18]

Similarly, to our findings, Ghosh AK investigated the effect of cement dust exposure on 127 cement factory workers with a mean of 10 years exposure to cement dust on lung function. [19] They found that pulmonary function test parameters were significantly lower in cement factory workers than in control subjects. Their results suggest that chronic cement dust exposure impairs lung function. Concurrently, Romer LM et al found that FVC, FEV1 were significantly reduced among the cement production workers but not among the controls. The reduction in lung function was probably associated with high cement dust exposure. [20]

Due to lack of data on the lung function parameters of construction workers in Iran, we examined the workers' lung function parameters. The mean lung function parameters, including FVC% and FEV_1%, were significantly lower among exposed construction workers, compared to the control group. Based on the findings, a significant relationship was observed between exposure construction material and reduction in pulmonary parameters, such as FVC and FEV_1.

In this study, reduction in lung function parameters versus the control group was in agreement with the results reported by Sawant A. [21] Tjoe-Nij found that obstructive pulmonary status or limitation is associated with exposure to crystalline silica in construction workers. [22] However, in this study, more than half of construction workers (51.8%) were diagnosed with moderate pulmonary restriction, and only 4.70% were classified as obstructive.

Conclusion

The present study adds evidence that cement dust adversely affects the respiratory functions and this impairment is association with duration of exposure to cement dust. The Findings are of Importance in that it highlights the need to overcome the effect of long term exposure. It also suggests that the workers must undergo pre-employment and periodic medical examination including lung function test. Thus, this study showed existing changes in pulmonary function related to dust exposure, and generated evidence to integrate primary prevention methods towards dust- related morbidity and mortality.

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