To evaluate of Pulmonary function tests among construction workers Versus fuel filling workers

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Abstract
Introduction: All construction sites generate high level of dust typically from concrete, silica, asbestos, cement, wood, stone, sand and the workers are exposed to this airborne dust. Dust and cement particles which are inhaled are lodged in the lung and causes lung irritation, mucus hypersecretion initially, followed by lung function impairment, lung inflammation chronic obstructive lung disease, restrictive lung disease and pneumoconiosis.

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: The present study was done in 150 participants (Group I -n=50, Group II n= 50, Group III n=50). 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. All the parameters of Pulmonary Function Test were significantly difference among 3 groups. In our study showed the prevalence of various respiratory symptoms in study and control group. Respiratory symptoms were more common among the study group as compare to control group. Overall prevalence of respiratory symptoms among study group more which is statistically significant when compared with control group.

Conclusion: The actual study found that mean values of spirometric parameters were lower in fuel filling workers and construction workers compared to controls with statistical significance. Lung functions of fuel filling workers and construction workers have been found to decrease in relation to exposure duration but reached significance only for small airways changes. This study reveals a decline in pulmonary functions in petrol pump workers.

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

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Introduction

All construction sites generate high level of dust typically from concrete, silica, asbestos, cement, wood, stone, sand and the workers are exposed to this airborne dust. Dust and cement particles which are inhaled are lodged in the lung and causes lung irritation, mucus hypersecretion initially, followed by lung function impairment, lung inflammation chronic obstructive lung disease, restrictive lung disease and pneumoconiosis and so on. [1] Street sweeping is associated with exposure to dust, during sweeping the streets with brooms, and by vehicular movement as well as other human activities raised several quantum of dust which are inhaled by the workers resulted in respiratory problems 9 and lung cancer as well as other types of cancer. [2]

A high incidence of cough, chronic bronchitis, sneezing and eye irritation coupled with infection of the throat has also been reported. The collection of household waste is a hard job, it also requires repeated heavy physical activity such as the manual lifting and handling of heavy bins exposure is also associated with health effects such as respiratory symptoms, influenza-like symptoms and increased risk of chronic obstructive pulmonary disease. [3]

The principal function of the lung is to efficiently exchange oxygen in the distal air spaces with carbon dioxide in the blood. Ventilation-perfusion matching is accomplished by structural attributes that create an enormous capillary surface area and exceedingly thin diffusion barrier for gas. [4] The airways, forming the connection between the outside world and the terminal respiratory units, are of central importance to our understanding of lung function in health and disease. [5]

Intrapulmonary airways are divided into three major groups: bronchi, membranous bronchioles and respiratory bronchioles/gas exchange ducts. Bronchi, by definition, have cartilage in their wall. Respiratory bronchioles serve a dual function as airways and as part of the alveolar volume (gas exchange). [6]

Secondary functions of the lung also are important, such as surfactant synthesis, secretion, and recycling, mucociliary clearance, immunomodulation, neuroendocrine signaling, and synthesis and secretion of a myriad of molecules by its epithelial and endothelial cells. The diversity of secondary functions emphasizes the importance of the lung in homeostasis. [7]

Pulmonary Function Tests (PFT) are performed in order to diagnose and classify disease processes that impair lung function. These tests detect the presence of pulmonary functional abnormalities, quantify their degree and follow the time course of disease. These tests are also helpful for assessing the risk of therapeutic or diagnostic interventions and to monitor the effects of therapy. [8]

Therefore all the respiratory parameters are changed depending on the relation between flow resistances of the measuring object and the transducer resulting in the measurement error. The permissible range of transducer resistance is in the range of 2–10% of the overall resistance of the respiratory tract. The error factor in FEV1 explains the influence of

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transducer resistance in normal and abnormal subjects. Analysis of error factors due to transducer resistance provides useful information about the interrelationship and significance of spirometric parameters. [9]

MATERIALS AND METHODS

Study design

This is a prospective, descriptive and observational study.

Study center

Department of Physiology, Index Medical College, Hospital and Research center Indore.

Study Period

Period of study from January 2021 to December 2022.

Eligibility criteria

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)

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.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

STUDY PARAMETERS:

1. **FEF 25-75%**
2. **Maximum Voluntary Ventilation (MVV)**
3. **Slow Vital Capacity (SVC)**
4. **Peak Expiratory Flow (PEF)**

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

Variables	**Group I**	**Group II**	**Group III**
PEFR	7.10±0.12	5.6±0.11	4.10±0.12
MVV	104±9.7	78.18±6.7	64±5.7

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FEF 25-75%	3.98 ± 0.84	2.44 ± 1.30	2.01 ± 0.71
SVC	4.01 ± 0.94	3.56 ± 0.40	3.03 ± 0.23

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

Table 4: Prevalence of respiratory symptoms in study and control group.

Respiratory symptoms	Group I	Group II	Group III
Cough-Dry	2	16	12
Dyspnoea	1	17	11
Cough-Productive	0	9	7
Wheeze	0	11	0
Sore throat	1	12	11
Haemoptosis	1	2	2

In table 4, showed the prevalence of various respiratory symptoms in study and control group. Respiratory symptoms were more common among the study group as compare to control group. Overall prevalence of respiratory symptoms among study group more which is statistically significant when compared with control group.

Discussion:

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 [10]. 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. [11]

Mehrotra PK found significantly lower PEFR values in their study as compare to healthy individuals in their study which is comparable PEFR (5.6±0.11 study group Versus 7.10±0.12 healthy group) in our study [12]. Mahajan S studied MVV significantly lower among construction site same interpretation was carried by our study with significant lower MVV (75.02±3.6) as compare to healthy individuals (68.18±2.7 study group Versus 104±1.7 healthy group) [13].

In the present study, PEFR, MVV values showed highly significant reduction as compare to control groups. The significant decrease in these values is indicative of obstructive type of changes in lung functions. Continuous exposure to dusty environment leads to inflammatory changes in small airways as well as in lung parenchyma leading to development of obstructive type of lung dysfunction. These obstructive types of changes among study group can be correlated with the duration of exposure to dusty environment at the construction site, as majority of the subjects in study group were occupationally exposed to PMs for 5 to 10 years on an average. Also, the prevalence of respiratory symptoms was more among the study group than the control group which can be explained on the same basis.

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Earlier studies evidenced that variations in spirometric measurements resulted into obstructive type of pulmonary dysfunction. [14] If the condition continued, the gradual deterioration of the lung function of the subjects lead to chronic disorders and other type of complications. The restrictive lung disease resulted in decrease in vital capacity and pulmonary parameters depending upon the duration of exposure to the dust. [15]

Occupational exposure of construction workers to respirable material and crystalline silica dust in this study was similar to the findings reported by Vedala S among Canadian and American construction workers. [16] However, occupational exposure of construction workers in our research was higher than exposures in recent studies on Canadian and American construction workers. [17] Excessive exposure in this study might be due to lack of engineering control measures and higher percentage of crystalline silica in Iranian cement, compared with other countries.

Conclusion:

The actual study found that mean values of spirometric parameters were lower in fuel filling workers and construction workers compared to controls with statistical significance. Lung functions of fuel filling workers and construction workers have been found to decrease in relation to exposure duration but reached significance only for small airways changes. This study reveals a decline in pulmonary functions in petrol pump workers. Till significant damage occurs the people remain asymptomatic, so it is suggested to owners of petrol pumps have regular health check-ups to their workers and insist on wearing masks provided. Taking care of protective measures can decrease morbidity. We also suggest that suspected or unhealthy people should be avoided to work in or around petrol pumps.

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ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

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