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Original Research Article

Study of Pulmonary Function Test in Labours of Tamil Population: A Retrospective Study

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Conflict of interest: Nil

Abstract

Background: Occupational exposure can lead to a wide range of lung diseases, affecting airways, interstitial lung diseases or even malignancies. Hence, the study of the reparatory system cannot be ignored.

Method: 250 (two hundred and fifty) labourers working in different factories where they were exposed to dust were studied for pulmonary function tests, and the same parameters were also applied in 100 (one hundred) healthy volunteers. The PFT machine was called as vitalograph. The best one out of three was recorded. The spirometry functions were recorded using an electronic, computerized, portable spirometre was carried out.

Results: Comparison of FVC (1), FEV_1 (1), FEV1/FVC and PEFR among labours who are smokers and non-smokers was carried out, and the p value was highly significant ($p<0.001$) similarly, the same parameters were compared in labours and the controlled group, and the p-value was highly significant ($p<0.001$).

Conclusion: The pulmonary function and respiratory function-related quality of life are considerably poor among labourers who are continually exposed to dust or polluted air.

Keywords: portable spirometre (vitalograph), Forced vital capacity, Forced expiratory volume, Interstiltial lung diseases.

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Introduction

According to the WHO, exposures to hazardous conditions in the living and working environment are among the risk factors of chronic disease mortality [1]. Occupational exposure can lead to a wide range of lung diseases or even malignancies. Occupational lung diseases are one of the most neglected conditions in the developing and underdeveloped countries, the developing ones like India, Bangladesh, Pakistan, Nepal, etc. [2].

This can be attributed to the major portion of the workforce still being in the unorganized sector and the lack of medical aid facilities coupled with poor awareness among the patients; poverty and undernutrition enhance these morbidities and mortalities.

The workers are exposed to a wide variety of physical and chemical environmental factors and are more prone to respiratory diseases [3].

Exposure to cement dust, a wide range of inorganic respiratory allergens, and welding fumes in the construction sites in the urban areas for longer periods has been proved to reduce lung function. It is reviewed that severe disabilities are also observed due to respiratory dysfunction, the need for continuous monitoring of respiratory function, and interventions to minimize the damage to lungs [4]. Hence, an attempt is made to evaluate the pulmonary function test in young adult laborers working in different industries where they were exposed to dust for a longer time to win their bread and butter.

Material and Method

250 (two hundred fifty) adult labours aged between 20 to 50 years regularly visited to Medicine department of Arunai Medical College Hospital, Thiruvanamali, Tamil Nadu, were studied.

Inclusion Criteria: Patients exposed to dust in factories and road repair work and construction work. These patients have respiratory problems. The patients who gave their consent for study were selected.

Apart from 250 patients, 100 (one hundred) volunteers were also included.

Exclusion Criteria: Patients below 20 years to above 60 years. The patients recently joined a factory or road-repair or construction site. The

patients are on treatment for cardiovascular disease and renal disease. Immunocompromised disease and pre-existing kyphoscoliosis deformity. Allergic Bronchitis patients were excluded from the study.

Method: 250 patients and 100 volunteers (controlled group) were subjected to a pulmonary function test.

The socio-demographic profile, which included sex, age, profession, socio-economic status, habits, smoking, consumption of alcohol and chewing tobacco, was recorded. The procedure of the pulmonary function test was explained to all, including volunteers (controlled group).

The pulmonary function tests were performed using a PFT machine called a Vitalograph. The best one out of three readings was noted.

The spirometry functions were recorded using an electronic, computerized, portable spirometer (VITALOGRAPH) in the sitting posture following the American Thoracic Society recommendations [5]. To get the best results, each person underwent the spirometry procedure three times, and one best of three was considered the ideal pulmonary function test. The following parameters were investigated.

- Forced vital capacity
- Forced expiratory volume in 1s (FEV1)
- FEV1/FEV percent ratio

FVC percentage rates greater than or equal to 80% of the predicted value were deemed normal, whereas values below 80% indicated bronchial obstruction. Based on the above parameters, the diagnosis was made for restrictive or obstructive pulmonary disorders.

The association of pulmonary function tests with a habit of smoking among factory (or industry) workers was also noted.

The duration of the study was from March 2020 to May 2022.

Statistical analysis: Comparison of pulmonary function parameters was compared in labors, among smokers and non-smokers, and labors and control groups with a t-test. The statistical analysis was carried out in SPSS software. The ratio of males and females was 2:1.

Observation and Results

Table 1: Comparative study of FVC (1), FEV_1 (1), FEV1/FEVC%, and PFER among smokers and non-smokers labour.

- FVC (1): 3.03 (± 0.3) in smokers, 4.33 (±0.40) in non-smokers; the t test was 29.06 and $p<0.001$.
- FEV_1 (1): 2.82 (± 0.26) in smokers, 3.92 (± 0.30) in non-smokers; the t test was 30.9 and $p<0.001$.
- FEV1 was 63.47 (± 5.40) in smokers, 78.70 (± 4.78) in non-smokers, t test was 23.6 and $p<0.001$.
- PEFR (1/min): was zero (0).

Table 2: Comparison of FEV (1), FEV_1 (1), FEV1/FVC (%), and PEFR (1/min) in labours and controlled group

- FVC (1): 3.84 (± 0.74) in labours, 4.43 (± 0.30) in the controlled group; t test was 7.71 and $p<0.001$.
- FEV_1 (1): 3.56 (± 0.58) in labours, 3.96 (± 0.34) in controlled group, t test was 6.46 and $p<0.001$.
- FEV1/FVC (%): 73.11 (± 7.68) in labours, 88.18 (± 3.44) in controlled group; t test was 18.8 and $p<0.001$.
- PFER (1/min): 496.68 (±58.26) in labours, 496.68 (± 30.24), t test: 14.5 and $p<0.001$.

Table 1: Comparison of FVC (1), FEV1 (1), FEV1/FVC% and PEFR among smokers and non-smokers (No. of patients: 250)

Parameters	Factory workers (Mean ±SD)		t test	p value
	Smokers (125)	Non-smokers (125)		
FEC(1)	3.03 (± 0.30)	4.33 (±0.40)	29.06	P<0.001
FEV1 (1)	2.82 (± 0.26)	3.92 (±0.30)	30.9	P<0.001
FEV1	63.47 (±5.40)	78.70 (± 4.78)	23.6	P<0.001
PEFR(1/min)	0	0	0	0

PVC – Forced Vital Capacity, FEV1- Forced expiry volume in 1s, PEFR – Peak expiration flow rate

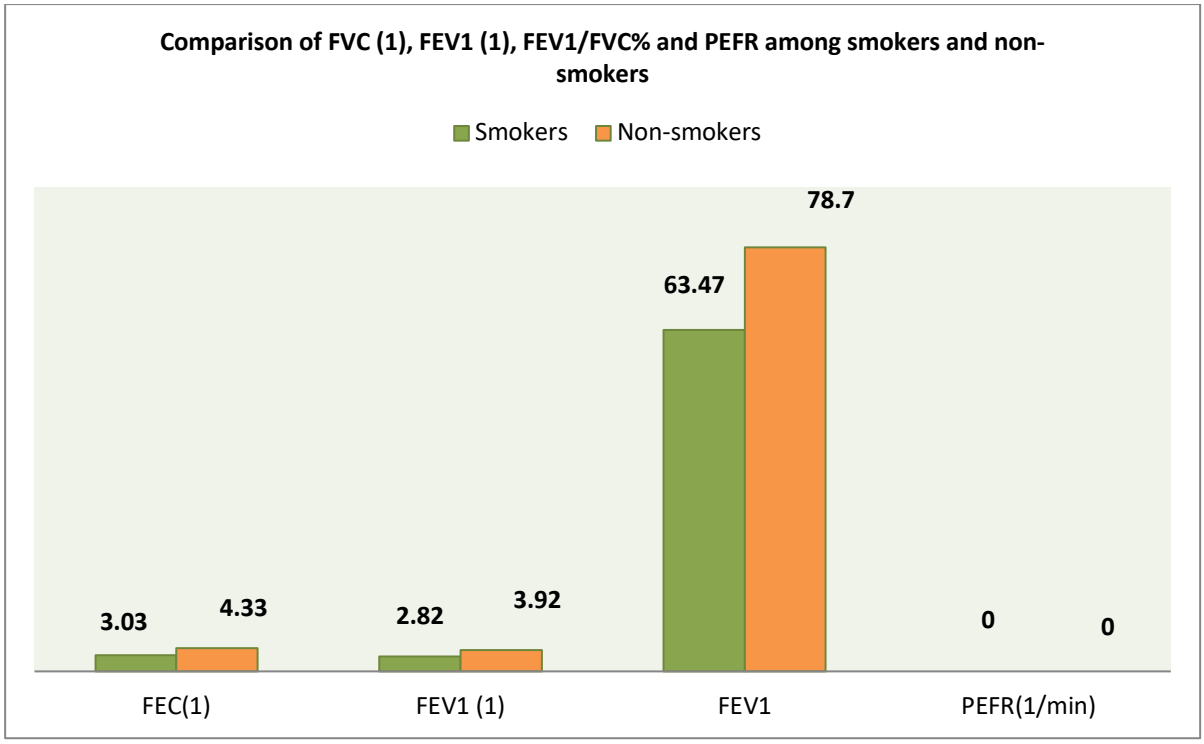

Figure 1: Comparison of FVC (1), FEV1 (1), FEV1/FVC% and PEFR among smokers and non-smokers

Table 2: Comparative study of FVC (1), FEV1 (1), FEV1/FVC (%) and PEFR (1/min)

Parameters	Factory workers (250)	Control group (100)	t test	p value
FVC (1)	3.84 (±0.74)	4.43 (±0.30)	7.71	P<0.001
FEV1 (1)	3.56 (±0.58)	3.96 (±0.34)	6.46	P<0.001
FEV1/FEVC (%)	73.11 (±7.68)	88.18 (±3.44)	18.8	P<0.001
PEFR (1/min)	446.94 (±28.22)	496.68 (±30.24)	14.5	P<0.001

(p<0.001 – p value is highly significant)

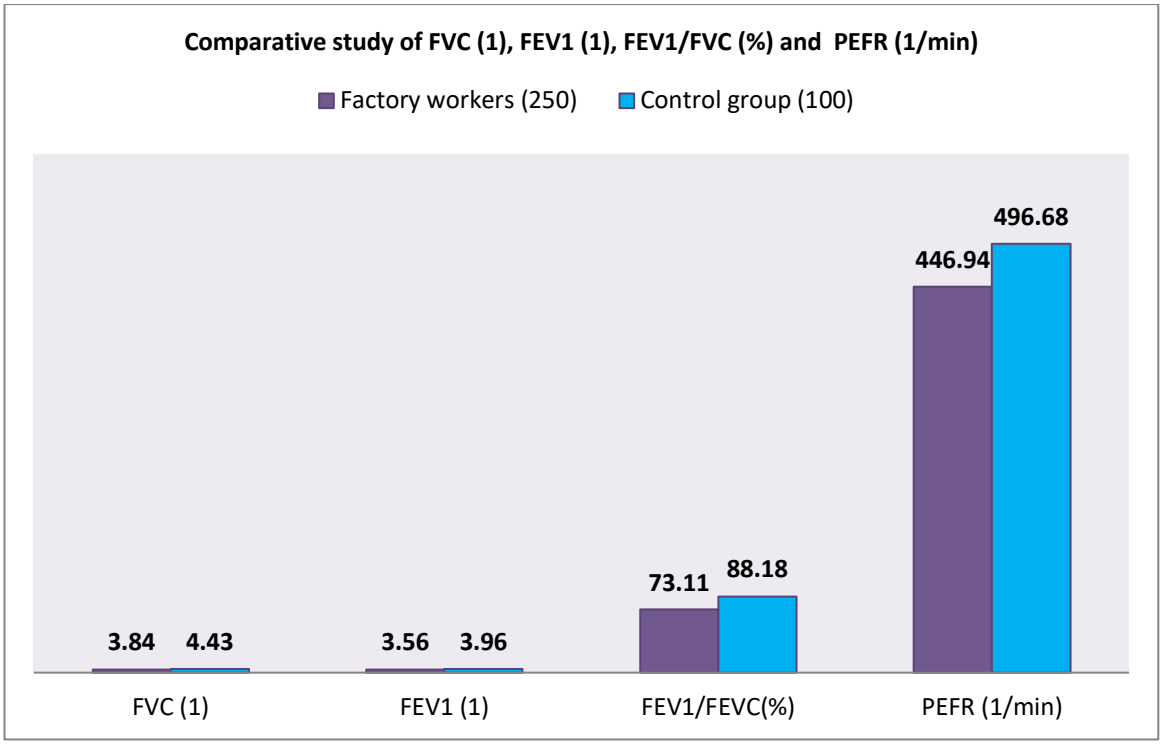

Figure 2: Comparative study of FVC (1), FEV1 (1), FEV1/FVC (%) and PEFR (1/min)

Discussion

Present study of pulmonary function tests in labourers exposed to dust or polluted air in the Tamil Nadu population. Among the labours, the pulmonary function test parameters were compared in smokers and non-smokers. The p-value was highly significant ($p<0.001$) (Table 1). The pulmonary function parameters were compared in labours and healthy volunteers (control group); the p value was highly significant ($p<0.001$) (Table 2). These findings are more or less in agreement with previous studies [6,7,8].

It is reported that the type of lung disease caused by metal compounds depends on the nature of the offending agent, its physicochemical form, dose, exposure conditions and host factors [9].

Chronic obstructive pulmonary disease may result from occupational exposure to mineral dusts, including some metallic dusts or from jobs involving the working of metal compounds such as wielding. Metallic dusts deposited in the lungs may give rise to pulmonary fibrosis, leading to respiratory problems, depending upon the fibrogenic potentiality of the agent and poorly understood host factors [10].

Inhalation of iron compounds causes siderosis, a pneumoconiosis with little or no fibrosis in welders. It is observed that they are more prone to bronchitis, siderosis, asthama and lung cancer [11].

In the occupations of painting, carpentry and packing, the labours are exposed to wood dust, lead dust and silica dust, which leads to respiratory diseases. All these changes promote wall thickening, which leads to airway narrowing and flow limitation [12].

In addition to that, inflammation causes destruction of alveolar walls attached to the airways, contributing to further airflow limitation by deforming and narrowing the airway lumen, which has reduced the pulmonary function [13].

Summary and Conclusion

The present study of pulmonary function tests in labourers exposed to dust and polluted air shows abnormal pulmonary function. It needs awareness among the labours regarding health hazards and preventive measures like masks for such labours.

The present study demands further nutritional, immunological, and environmental studies because the exact pathogenesis of pulmonary diseases is yet to be known.

Limitation of Study: Owing to the tertiary location of the research center, the small number of patients, and the lack of the latest technologies, we have limited findings and results.

This research work was approved by the Ethical Committee of the Arunai Medical College hospital Thiruvanamali, Tamil Nadu-606603.

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