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Original Article

A study on pulmonary function test in petrolpump workers in kanchepuram population

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A R T I C L E I N F O

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A B S T R A C T

Pulmonary Function Testing (PFTs) is a valuable tool for evaluating the respiratory system, representing an important adjunct to the various lung imaging studies. It also measures the function of lung capacity and chest wall mechanics to determine whether or not the patient has a lung problem.Spirometry gives an important clue in terms of respiratory chronic airway disorders and can predict early damage to pulmonary system. Occupational exposures to petrol/ diesel vapors affect the different systems of the body. The present study has focused on the workers engaged in petrol pump workers (filling attendants) who are continuously exposed to air pollutants such as petrol / diesel vapors during duty hours in Kanchipuram population.Thirty healthy non – smoker male working in petrol pump for more than three years formed the study group, while thirty healthy non–smoker males who are not exposed to air pollutants from hospital staff served as control group. The pulmonary function test was assessed using computerized spirometer.The pulmonary function test (FVC, FEV1, FEV1/FVC%, FEF25 – 75% and PEFR) were significantly decreased in petrol pump workers.The results suggest that there in a need to improve control measures and the health status of workers engaged in petrol fumes.

1. Introduction

The environmental consequences of any occupation has not received enough weightage in public health management and occupational medicine so, due importance has to be given to exposed workers. In most towns and cities the automobiles increase in air pollution is a cause of grave concern[1]. Rapid industrialization, urbanization, use of motor vehicles are the major causes of environmental pollution in the world. The airborne dust plays a major part in the overall atmospheric pollution and motor vehicle emissions constitute the most significant source of ultrafine particles in an urban environment [2] . Petrol is a complex combination of hydrocarbons. About 95% of the components in petrol vapour are aliphatic and acyclic compounds[3]. Health effects of occupational exposure to gasoline and air pollution from vehicular sources are relatively unexplored among petrol filling workers[4].

Diesel exhaust fumes are a complex mixture of particulate and gas phase pollutants. The highly respirable particles consist mainly of a carbonaceous core and adsorbed organic compounds. Gas phase components, particularly SO2, may subsequently undergo gas to particle reactions and form secondary particulate. The carbon core is defined as elemental carbon (EC) and adsorbed organics as organic carbon (OC) [5,6]. When inhaled, these cause damage to the airways and the lungs.The particles increase the toxicity of the chemicals present in the smoke[7]. The effects of air pollution include chronic cough, Wheezing, breathlessness and alterations in the body defense systems against foreign materials, damage to lung tissue and carcinogenesis [8,9].

Various occupational solvents like benzene and atmospheric polluted air are absorbed into the human body either through the respiratory tract or via epidermal contact [10]. These may cause primary respiratory symptoms and impaired pulmonary function.

At high ambient concentrations of solvents and air pollutants, well-defined and marked systemic pulmonary inflammatory response is also observed [11].

The present study was carried out on the male petrol pump workers in Kanchipuram population exposed to the solvents in petrol pump.

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2.Materials and Methods

The institutional ethical committee approval was obtained.

2.1.Study population:

The present study was conducted in the department of physiology, Meenakshi Medical College & Hospital, Kanchipuram. The study group (group I) consisted of thirty healthy non – smoker males in the age group of 25-50 years working in petrol pump for more than three years were selected. They were selected from the petrol pump which is located in the pollution zones. While thirty age matched healthy male nonsmokers, working as hospital staff are taken as controls (group II).

Subjects with clinical abnormalities of the neuromuscular diseases, known cases of gross anemia, diabetes mellitus, pulmonary tuberculosis, bronchial asthma, chronic bronchitis, bronchiectasis, emphysema and malignancy were excluded from the study. The subjects who had undergone abdominal or chest surgery were also excluded from the study.

2.2.Pulmonary Function Test:

The pulmonary function tests was carried out using an computerized spirometer (Helios 401 RMS) using the standard laboratory methods. The spirometer was calibrated regularly and a brief physical and general examination was carried out and the anthropometric parameters (name, age, sex, height, weight, occupation, and smoker / nonsmoker) was entered in the computer. All the pulmonary function tests were done on the subjects comfortably in an upright position. During the test, the subject was adequately encouraged to perform their optimum level and also a nose clip was applied during the entire maneuver. Tests were repeated three times and the best matching results were considered for analysis. The parameters measured by the apparatus were the Forced vital capacity (FVC), Forced Expiratory Volume in 1st second (FEVI), FEVI /FVC , Forced Expiratory Flow in 25% - 75% (FEF25 -75%), and Peak Expiratory Flow Rate (PEFR) with graphic curves were obtained.

2.3.Statistical analysis:

The data of pulmonary function tests were presented as the Mean ± Standard deviation for each of the parameter. The two groups were compared by using student t test by spss software.

3.Results:

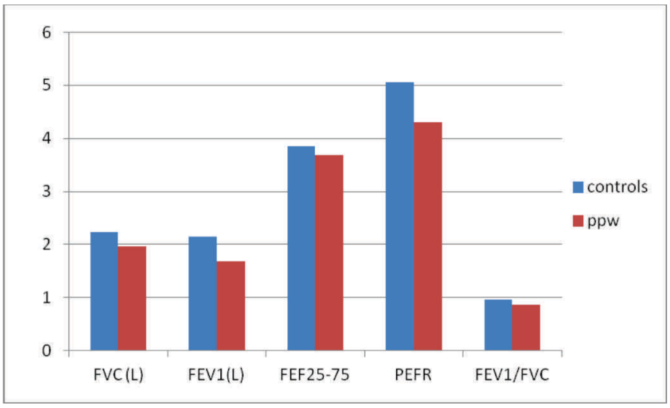
The anthropometric parameters of study group were age 26.625 ± 4.89 years, weight 60.93 ±10.13kg, height 168.07 ± 8.72 cms while that of controls were age 24.90 ± 3.09 years, weight 62.67 ± 8.52 kg, height 172.67 ± 6.26 cms.

3.1.Pulmonary Function test:

The mean values of the lung function parameters for the petrol pump workers and matched controls are presented in the below table. The FVC (L), FEV_1 (L), FEF25-75 , PEFR (as a percentage of predicted) was seen to significantly decreased in petrol pump workers . The Present study demonstrates that there is altered lung function in petrol-filling workers due to chronic exposure. When compared to the predicted values there was statistically significant decline in the values of FVC(L), FEV_1(L), FEF25-75 and PEFR , but there is no significant change in FEV_1/FVC.

Lung function parameters for petrol pump workers and controls

Parameters	Controls	Petrol pump workers	P value
FVC (L)	2.24±0.44	1.97± 0.348	<0.01
FEV_1(L)	2.15±0.39	1.68±0.286	<0.01
FEF25-75	0.96±0.05	0.86±0.074	<0.01
PEFR	5.05±0.70	4.30±0.85	<0.01
FEV_1/FVC	3.85±0.76	3.68±1.018	>0.05



4.Discussion

Inhalation of dust is an important cause of interstitial lung disease in India [12]. The present study was designed to quantify resulting abnormalities in lung function in subjects exposed to petrol vapors as compared to their matched control. The present study demonstrates that prolonged exposure to petrol vapors markedly decreased the pulmonary function who were exposed to petrol vapors more than 3 years showed a significant reduction in FVC, FEV1, FEF25 -75% and PEFR relative to their matched controls.

The main source of particles in accumulation mode (most intimately related to lung function impairment in urban air) is the coagulation of ultrafine particles (0.01–0.1 μm) present in automobile exhausts [13]. FEF25-75 is considered a fairly good test to identify early small airway disease[14-16]. Kesavachandran et al found that high prevalence of respiratory symptoms was primarily a consequence of exposure to the petrol vapors found in the work place in the petrol filling stations [3].

The propable cause for the decrease in pulmonary function test is the accumulation in peri-bronchial lymphoid and connective tissues along with varying degrees of wall thickening and remodeling in terminal and respiratory bronchioles arising from each pathway . Bronchiolar walls with marked thickening contained moderate to heavy amounts of carbon and mineral dust; and wall thickening is associated with increase in collagen and interstitial inflammatory cells including dust-laden macrophages[17]. Zuskin et al, Lee et al found that the exposure to solvents at work place had significantly more respiratory symptoms than control group [18,19].

A graphical representation of lung function versus time spent at the petrol stations shows that subjects who had worked for a longer duration at the petrol stations had lower 'percentage of predicted values' for most of the parameters studied. This reduction is not due to increasing age of subjects. It is likely that this decline in lung function is due to the factors such as exposure to air pollutants, fuel vapour inhalation.The present study indicates the exposure to solvents and air pollutants leads to restrictive type of lung disease . But the exposure more than three years of chronic exposure , the restrictive lung disease was changed to mixed pattern of lung disease. While short term exposure to diesel exhaust in healthy human volunteers have demonstrated marked systemic and pulmonary inflammatory response . The FEV1 and FVC are both decreased in petrol pump workers and their ratio was not significant between the two groups. Since petrol pumps are located on busy roads, hence these workers in addition to diesel exhaust exposed to other pollutants.

The particles generated from petrol exhaust are extremely small and are present in the nuclei or accumulation modes, with diameters of 0.02nm and 0.2nm respectively and as the surface area is large they can carry much larger fraction of toxic compounds, such as hydrocarbons and metals on their surface[20]. They can remain airborne for longer period and deposit in greater numbers and deeper into the smaller airways and the lungs than large sized particles [21].

5.Conclusion:

The data suggests that air pollutants could account for substantial part of respiratory dysfunctioning. In order to prevent these among petrol filling workers the stratagies of use of mask, regular health check up and awareness on health impacts of pollution need to be adopted for protection of petrol pump workers. A large number of epidemiological studies have shown that long term exposure to the particulates is associated with adverse effects on health.22.Control strategies should to adopt to reduce the benzene concentration in the ambient air and evaporation control. Thus medical screening and screening of benzene and CO in air may protect workers from developing chronic respiratory disorders.

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