

PULMONARY FUNCTION CHANGES IN SANITARY WORKERS OF KANCHIPURAM POPULATION

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ABSTRACT

Objectives: The main objective of this study is to evaluate the respiratory function of sanitary workers as they are most exposed to environmental air pollutants.

Methods: The study was done among sanitary workers of Kanchipuram Municipality, Tamil Nadu, with 190 subjects, who were divided into two groups such as Group I and Group II. Group I with 96 sanitary workers and Group II with 94 as the control group with age- and morphometric-matched subjects. The subjects involved are both gender with the age group between 20 and 60 years. Various functional parameters, namely FVC, FEV1, FVC/FEV1, FEF 25%, FEF50%, and FEF75%, were done using RMS Helios 3.1.37 in the Physiology Department, Meenakshi Medical College and Research Institute. Institutional Ethical Committee approval was obtained from Institutional Human Ethical Committee.

Results: The pulmonary findings showed a significant decrease in FVC, FEV1, FVC/FEV1, FEF 25%, FEF50%, and FEF75% when compared to the control group.

Conclusion: The sanitary workers showed a significant decrease in the pulmonary function tests as they were exposed to a variety of solid waste particles which might have caused inflammatory and immunological responses with the small and large airways of the respiratory tract.

Keywords: Occupational lung diseases, Pulmonary function tests, Respiratory tract, Sanitary workers.

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INTRODUCTION

A huge group of the human population is involved manually in garbage collection and street sweeping even in this modern civilization. These people help us keep our streets and cities clean and tidy. They also clean the solid waste produced by human beings without any hesitation. Occupational lung diseases are the most prevailing occupational illness. The incidence of work-related pulmonary problems seems to be greater in sanitary workers than in the general workforce [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 which raise several quantum of dust which are inhaled by these people. All these exposures resulted in respiratory problems and lung cancer as well [2]. Risk occurs at every step in the process. They are exposed to occupational health and accident risks related to the content of the materials handled, emissions from those materials, and the equipment being used. In areas, infectious medical waste and toxic industrial waste are not segregated from domestic waste, waste collectors are exposed to a wide array of risks [3].

In a study on the pattern of lung disease among street sweepers of Nagpur, India, chronic bronchitis was significantly more prevalent among garbage collectors than in a control group [4]. Similar studies revealed that chronic bronchitis and asthma were significantly higher in Copenhagen trash sweepers [5]. Spirometry is very useful in diagnosing respiratory dysfunctions. Nevertheless, in particular circumstances, measurements of lung volumes are strictly necessary for a correct physiological diagnosis [6]. Lung function is altered by various other factors such as sex, age, height, weight, and environment. This study was done with the idea to determine the prevalence of respiratory disease symptoms and variations in the parameters of pulmonary function tests among the garbage collectors of Kanchipuram district in Tamil Nadu.

METHODS

The study was a comparative study done in the Department of Physiology, Meenakshi Medical College and Research Institute on sanitary workers of Kanchipuram Municipality. The protocol was approved by the human ethical committee in MAHER University. The pulmonary functions were assessed using RMS HELIOS version 3.1.37. The parameters assessed were FVC, FEV1, FEV1/FVC, FEF 25%, FEF 50%, and FEF 75%. The study was done on 190 subjects, who were divided into two groups with 96 sanitary subjects and 94 subjects in the control group. The age group of 20–60 years was selected for the study and their consent was taken. People who suffered from any cardiovascular diseases, bronchial asthma, obese people, and smokers were excluded from the study. Their anthropometric measurements such as height and weight were recorded. The pulmonary changes of sanitary workers were compared with that of the normal (control) group. The data were analyzed by SPSS 17.0 version and by students' t-test. The study was done in January 2015 in Kanchipuram Municipality in Tamil Nadu.

RESULTS

A comparison of FVC, FEV1, FEV1/FVC RATIO, FEF25%, FEF50%, and FEF75% in sanitary workers and control group is shown in Table 1.

The values obtained from the pulmonary function test of sanitary workers and the control groups to assess FVC, FEV1, FVC/FEV1, and FEF25 – 75%, were expressed as mean SD. $p < 0.05$ was accepted as the significant difference between the compared values. The spirometry values, namely FVC, FEV1, FEF 25%, and FEF 75%, showed a significant decrease when compared to their control group. The value of FEV1/FVC and FEF50% is not statistically significant.

DISCUSSION

This study was conducted with the purpose of finding out the outcome of pulmonary function changes in the sanitary workers of Kanchipuram

Table 1: PFT parameter of control and test (sanitary workers) group

Parameters	Control group	Test group	p-value
FVC	96.65±6.578	76.32±1.767	0.0035
FEV1	103.5±1.782	90.85±2.187	0.0001
FEV1/FVC	122.6±6.418	118.3±1.858	0.5199
FEF25%	85.39±1.867	76.54±2.313	0.0031
FEF50%	78.49±1.973	72.97±2.484	0.0827
FEF75%	70.90±2.064	88.03±8.049	0.0388

Municipality, a less focused population not following the preventive measures during their occupation. The cities of our country are clean because of this unique workforce, the sanitary workers. These people work hard throughout all days of the week to provide better sanitation. In spite of the hazards of this work and the reckless behavior of the public toward them, they put their effort to keep it hygienic. The pulmonary function data for the sanitary workers represented in Table 1 were matched for FVC, FEV1, FVC/FEV1, and FEF25–75% showed marked differences with their control group and this could be due to the nature of their occupation such as cleaning, collecting, and disposing of the waste materials without any preventive measures. This may lead to exposure of dust, bioaerosols, decomposable organic materials, harmful chemicals, irritants, sharp objects, etc.

Exposure to bioaerosols such as fungi, 1, 3 beta-glucan, and endotoxin can cause inflammation in respiratory airways, which might increase respiratory symptoms and chronic obstructive pulmonary disease [7]. The prevalence of pulmonary changes in sanitary workers was significantly higher in sanitary workers when compared to the control and it was aggravated by their occupational exposure, duration of exposure, nature, and type of work [8-10]. The production of pro-inflammatory cytokines such as interleukin 1 beta, interleukin 6, interleukin 8, and tissue necrosis factor-alpha play a major role in these inflammatory processes [11,12].

According to the result obtained, there was a significant decrease in FVC, FEV1, FEF25%, and FEF75%. The significant decrease in these parameters might be due to interleukins and tissue necrosis factor-alpha that may act through systemic inflammation to adversely affect pulmonary functions. Currently, there are two studies that have reported that exposure to bio-aerosol is related to the presence of airway inflammation and subsequent symptoms in workers in the household waste collecting and organic waste composting industry [13].

This study concurs with the findings of Kumari *et al.* [14] emphasized that there is a thickening of alveolar epithelium and pulmonary capillary basal laminar which led to reduced pulmonary elastic recoil due to non-enzymatic glycosylation of connective tissues reducing the FEF25% and FEF50%. A similar study by Marth *et al.*, [15] in Australia, did not observe any significant differences in lung functional parameters between sanitary workers and the control group. Differences in study design, length of exposure to that work, and many other factors may explain these contradictory results. Moreover, the difference in the level of mechanization systems for gathering, transportation, disposal, recycling, and pollution levels may also play a significant role in this scenario. Similarly, while these coincide well with the spirometry pattern of obstructive lung disorders. The parameters: FVC, FEV1, and FEV1/FVC provide the best method of detecting the presence and severity of airway obstruction, as well as overall respiratory impairment.

The dust that are floating in the vicinity of their workplace due to various construction activity enters into their respiratory pathway through the nose and mouth leading to chronic respiratory disease and the reduction of ventilator capacities. Several previous reports have shown increased respiratory symptoms among workers of different categories supporting the results of the present study [16-19].

Occupational respiratory diseases are usually caused by extended exposure to irritating or toxic substances that may cause acute or chronic respiratory ailments [20,21]. The incidence depends upon the chemical composition of the dust, the size of the particle, the duration of exposure, and individual susceptibility [22]. Similarly, two other studies which were conducted on sweepers revealed that chronic respiratory diseases such as chronic bronchitis, asthma, and bronchiectasis were significantly high among street sweepers (5.9%) than among subjects of the comparison group [23,24]. The sanitary workers in our study showed altered pulmonary function tests because these people rarely use any protective devices such as face masks, gloves, and boots and expose to high dust levels at the working site. The prevalence of the symptoms among this occupation gives an impact that awareness should be created regarding the ill effects of being exposed without any protective measures.

The reduction in FEV1 and PEFV associated with chronic sweeping can be partially explained by the loss of lung elastic recoil pressure which reduces the force required to drive air out of the lung [25]. In our study, FVC, FEV1, and FEV1/FVC ratio were decreased and it was more toward obstructive pulmonary impairment. FEF25–75%, the more sensitive indicator of small airway obstruction was also found to be reduced. All the above findings suggested obstructive lung function impairments in sweepers, which may be attributed to inhalation of mixture of dust which affects the airways in different ways.

CONCLUSION

The prevalence of respiratory symptoms and impaired lung functional capacities was more common among the sanitary workers when compared with the normal control group. The decreased lung functional parameters, such as FVC, FEV1, FEF25%, FEF50%, and FEV1\FVC ratio, resulted in obstructive pattern of lung function impairment, which is mainly associated with years of exposure and airborne dust in the workplace. To reduce or prevent this impact on these people, they should use protective face masks, boots, hand gloves, use wet sweeping instead of dry sweeping, watering of the streets, and mainly plant many trees to reduce the pollution from industries and vehicles. All these measures may reduce the inhalation of dust by the sanitary workers in future.

AUTHORS CONTRIBUTION

MP and SC conceived and designed the study. MP collected the data. The data were analyzed and interpreted by MP, KV, and SC. The manuscript was written by MP, KV. The manuscript was revised and accepted by MP, KV, and SC.

CONFLICTS OF INTERESTS

There is no conflict of interest.

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