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A Study of Pulmonary Function Changes in Sanitary Workers of Madurai Population

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Abstract

In the present study to investigate that the pulmonary changes in the sanitary workers of Madurai population in Tamil Nadu, India. Respiratory disorders are the most common occupational diseases. Municipal solid waste handling and disposal is a growing environmental and public health concern. Garbage collectors are occupationally exposed to a variety of solid waste and airborne contaminants. The main objective of this study is to evaluate the respiratory states of the sanitary workers. This is observational study. The study was done among sanitary workers of Madurai municipality, Tamil Nadu, with 190 subjects, who were divided into 2 groups like Group I and Group II. Group I with 96 sanitary workers and Group II with 94 as control group with age and morphometric matched subjects. The subjects involved are both sex with the age group between 20 -60 years. Various functional parameters like FVC, FEV1, FVC/FEV1, FEF 25%, FEF50%, FEF75% were done using RMS Helios 3.1.37. Results: In sanitary workers pulmonary findings showed a significant decrease in FVC, FEV1, FVC/FEV1, FEF 25%, FEF50%, FEF75% when compared to the control normal subjects. In the present study we conclude that the sanitary workers showed a significant decrease in the pulmonary function tests as they were exposed to variety of solid waste particles which might have caused inflammatory and immunological response with the small and large airways of the respiratory tract.

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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 seem to be greater in sanitary workers than the general workforce (Athanasios *et al.*, 2010). 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 exposure resulted in respiratory problems and lung cancer as well (Mariammal *et al.*, 2012). 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 equipments 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 (World Bank Group, 2006). In a study on the pattern of lung disease among street sweepers of Nagpur, India, chronic bronchitis was significantly more prevalent among the garbage collectors than in a control group (Krajewski *et al.*,

2002). Similar studies revealed that chronic bronchitis and asthma were significantly higher in Copenhagen trash sweepers (Masoud Neghab *et al.*, 2008). Spirometry is very useful in diagnosing the respiratory dysfunctions. Nevertheless in particular circumstances measurements of lung volumes are strictly necessary for a correct physiological diagnosis (Pellegrino *et al.*, 2005). 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.

Materials and Methods

The study was a comparative study done in the department of Community Medicine, Madurai Medical College on sanitary workers of Madurai municipality. The protocol was approved by the institutional ethical committee. The pulmonary functions were assessed using RMS HELIOS version 3.1.37. The parameters assessed were FVC, FEV1, FEV1\FVC, FEF 25%, FEF 50%, FEF 75%. The study was done on 190 subjects, who were divided into 2 groups with 96 sanitary subjects and 94 the control group. The age group of 20 to 60 years were selected for the study and their consent was taken. People who suffered from any cardiovascular diseases, bronchial asthma, obese people, and smokers were excluded. Their anthropometric measurements like height, weight were recorded. The pulmonary changes of sanitary workers were compared with that of the normal (control) group. The data's were analysed by SPSS 17.0 version, and by students' T test. It is a comparative study. The study was done in the year of 2020 in Madurai.

Results and Discussion

Comparison of FVC, FEV1, FEV1/FVC RATIO, FEF25%, FEF50%, FEF75% in sanitary workers and control

Table.1. shows that the values obtained from pulmonary function test of sanitary workers and the control groups to assess FVC, FEV1, FVC/FEV1, FEF25 – 75%, were expressed as mean SD. P value of less than 0.05 were accepted as the significant difference between the compared values. The spirometric values like FVC, FEV1, FEV1\FVC, FEF 25%, FEF 50%, FEF 75%

showed a significant decrease when compared to their control group.

This study was conducted with the purpose of finding out the outcome of pulmonary function changes in the sanitary workers of Madurai municipality, a less focused population not following the preventive measures during their occupation. The cities of our country are clean because of this different race of human species, the sanitary workers. These people work hard throughout all days of the week to provide a better sanitation.

Inspite the hazards of this work and reckless behaviour of the public towards them, they put their effort to keep it hygiene. The pulmonary function data for the sanitary workers represented in table 1, were matched for FVC, FEV1, FVC/FEV1, FEF25-75% showed marked difference with their control group and this could be due to nature of their occupation like cleaning, collecting and disposing the waste materials without any preventive measures. This may lead to exposure of dust, bioaerosols, decomposable organic materials, harmful chemicals, irritants, sharp objects, etc.

The exposure to bioaerosols such as fungi, 1, 3 beta glucan, endotoxin can cause inflammation in respiratory airways, which might increase respiratory symptoms and chronic obstructive pulmonary disease (Matheson *et al.*, 2005). The prevalence of pulmonary changes in sanitary workers were significantly higher in sanitary workers when compared to control and it was aggravated by their occupational exposure, duration of exposure, nature and type of work etc. (Mohammad Hossain Boskabady *et al.*, 2010; Sornaraj *et al.*, 2008; Priha *et al.*, 2004). 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 (Ulmer, 1997; Michel, 1997).

According to the result obtained, there was a significant decrease in FVC, FEV1, FEV1\FVC ratio, FEF25%, FEF50%, FEF75%. The significant decrease in these parameters might be due to interleukins, tissue necrosis factor alpha, that may act via systemic inflammation to adversely affect the pulmonary functions. Recently, two studies have specifically related exposure to bioaerosol to the presence of airway inflammation and subsequent symptoms in workers in the household waste collecting and organic waste composting industry (Douwes *et al.*, 2000).

Table.1 Pulmonary function test of sanitary workers and the control groups

Parameters	Control	Subject	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

This study concurs with the findings of Kanyakumari *et al.*, (2011) emphasized that there is a thickening of alveolar epithelium and pulmonary capillary basal lamina which led to reduced pulmonary elastic recoil due to non-enzymatic glycosylation of connective tissues reducing the FEF25%, FEF50%. A similar study by Egon Marth *et al.*, (1997) 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, pollution levels may also play a significant role in this scenario. Similarly, while these coincide well with the spirometric pattern of obstructive lung disorders. The parameters FVC, FEV1, 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 their vicinity due to various construction activity enter into their respiratory pathway through nose and mouth leading to chronic respiratory disease and the reduction of ventilator capacities. Several previous studies have shown increased respiratory symptoms among workers of different category supporting the results of the present study (Faezeh Dehghan *et al.*, 2009; AlaEldin Hassan Ahmed *et al.*, 2009; Rastogi *et al.*, 2003; Janusz milanowski *et al.*, 2002). Occupational respiratory diseases are usually caused by extended exposure to irritating or toxic substances that may cause acute or chronic respiratory ailments (Park, 2007; Karjalainen *et al.*, 2003).

The incidence depends upon the chemical composition of dust, size of the particle, duration of exposure and individual susceptibility (Kasper *et al.*, 2008). Similarly, two other studies which were conducted on sweepers revealed that chronic respiratory diseases like chronic bronchitis, asthma and bronchiectasis were significantly

high among street sweepers (5.9%) than among subjects of the comparison group (Yogesh and Sanjay, 2008; Yogesh *et al.*, 2008). The sanitary workers, in our study showed altered pulmonary function test because these people rarely use any protective devices like face mask, gloves, boots etc. and expose to high dust level 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 exposing without any protective measures.

The reduction in FEV1 and PEFr is associated with chronic sweeping can be partially explained by loss of lung elastic recoil pressure which reduces the force required to drive out of the lung (Ajay *et al.*, 2014). In our study FVC, FEV1, FEV1/FVC ratio was decreased and it was more towards 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.

The prevalence of respiratory symptoms, impaired lung functional capacities was more common among the sanitary workers when compared with the normal control group. The decreased lung functional parameters like FVC, FEV1, FEF25%, FEF50%, FEV1\FVC ratio, resulted in obstructive pattern of lung function impairment, which is mainly in association with the years of exposure and airborne dust in the work place. In order to reduce or prevent this impact on these people, they should use protective face mask, boots, hand gloves, use wet sweeping instead of dry sweeping, watering of the streets, 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.

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