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Original Research Paper

Pulmonary Function Test in Street Sweepers Compared to General Population of Hyderabad, India

Medical Science

KEYWORDS : Street Sweepers, Dust, Pulmonary function test (PFT), Spirometry, Respiratory Disease.

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ABSTRACT

***Background**: Occupational pulmonary diseases are more widespread and disabling than any other group of occupational diseases. Among the street sweepers, due to their nature of work the prolonged exposure to dust has been associated with prevalence of varying degree of airway obstruction and various other respiratory symptoms. Therefore, in the present study the pulmonary function test was done on street sweepers of Hyderabad to evaluate their respiratory function. **Materials and Methods**: A cross sectional comparative study was conducted among 86 street sweepers compared with age and sex –matched healthy controls.Spirometer was used to evaluate the pulmonary function tests among both the groups. **Results**: Pulmonary function test parameters like FVC, FEV1, FEV1/FVC%, PEFR and FEF25-75% were significantly decreased (p≤0.01) in street sweepers when compared to the control group. **Conclusion**: This study reveals that prolonged exposure to dust in street sweepers has resulted in obstructive pattern of lung impairment in them.*

INTRODUCTION

In the developing country like India, the prevalence of occupational health hazards has been reported to be unusually very high among various workers. [1] One such occupational health hazard is associated with sweeping among the street sweepers due to the prolonged exposure to dust. The job exposes the street sweepers to complex mixture of soil, sand particles, dust, bio-aerosols, toxins, vehicles exhaust and plant particles.[2] Dust particles which are inhaled are lodged in the respiratory tract, causing lung irritation, mucus hyper secretion initially, followed by lung inflammation, obstructive lung disease, restrictive lung disease and leading to various irreversible lung tissue destruction. [3-6]

In developing countries like India very less attention has been paid to the health of the workers who are chronically exposed to dust, raised by street sweeping without any precautionary measures. Various workers exposed to dust during their occupation develop various respiratory symptoms; more commonly develop the obstructive type of lung disease [7-10]

In occupational respiratory diseases, assessment of pulmonary function tests using spirometry has opened a new era towards scientific approach in diagnosis, prognosis and management of pulmonary disorders by the early recognition of their impairment. Spirometry is a valuable tool to assess lung function in the initial asymptomatic stages of respiratory dysfunction, as compared to other tools. [11] It has been documented that only spirometry enables the detection of chronic obstructive pulmonary disease (COPD) - five to ten years before shortness of breath develops. [12]

This was the first study undertaken among street sweepers of Hyderabad, to assess the impact of occupational hazard associated with street sweeping by assessing pulmonary function test (PFT) using spirometer in street sweepers with general population who were not involved in street sweeping or exposed to any kind of dust.

Materials and methods

A total of 86 street sweepers from various areas of whole Hyderabad city were selected by simple random sampling. Non smoking street sweepers who have been working in the same profession for more than 5 years out of which 32 males and 54 females in the age group of 25-50 years were selected for the study. 86 age, sex, height and weight matched healthy controls were chosen from the general population of Hyderabad randomly, who were not exposed to any kind of dust at their work places, like nurses, teachers,IT professionals and office clerks. The subject with the history of smoking, familial asthma or any chronic respiratory illness, significant cardiovascular disorders, chronic debilitating disease, spinal or skeletal deformities and obesity were excluded from the study. Ethical committee clearance was taken for the study. General physical examination; systemic examination was done on them along with recording of Weight, Height, BMI, Vitals. Subjects were tested for PFT using portable spirometer connected to lap-top, RMS HELIOS 401 HELS/110540/401.PFT parameters measured were FORCED VITAL CAPACITY (FVC in litres),FORCED EXPIRATORY VOLUME (FEV1 in litres),FEV1/FVC %,PEAK EXPIRATORY FLOW RATE (PEFR in litres/sec) and FORCED MID- EXPIRATORY FLOW RATE ($FEF_{25-75\%}$ litres/sec). In relaxed sitting posture the subject was asked to perform maximum inhalation followed by maximum exhalation using spirometer. The values were obtained both in graphical pattern & numerical value.

Statistical analysis: The data was analyzed using SPSS software version 17. Unpaired t test was used for sweepers and non-sweepers control group for comparisons, p value of 0.05 or less was considered statistically significant.

Results and observations: Table 1 shows the comparison of mean values of anthropometric parameters in controls and sweepers. There is no significance difference noted in age, height and weight between the groups.

Table 2 depicts the comparison of the PFT parameters in male &female sweepers with male & female control groups expressed in mean with SD values. Females had lower pulmonary functions than males. It was observed that all the lung parameters FVC, FEV1, FEV1/FVC, PEFR and FEF (25-75%) in male and female sweepers were reduced which were

statistically significant($p < 0.05$).

Table 1

Parameters	Controls(non-sweepers) Males(n=32) Females(n=54)	Subjects(sweepers) Males(n=32) Females(n=5)	p value Males	Females
Age(years)	36.2±5.35 33.08±4.86	34.8±4.74	33.4±4.60	0.84 0.96
Height(cms)	159.9±10.9 156.4±7.20	158.4±9.8	156.8±7.7	0.91 0.97
Weight(kgs)	66.4±6.55 56.8±10.7	61.8±6.21	56.8±11.2	0.60 0.99

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Table 2

Parameters	Controls(non-sweepers) Males(n=32) Females(n=54)	Subjects(sweepers) Males(n=32) Females(n=54)	p value Males Females
FVC(lts)	3.10±0.26 2.59±0.25	2.41±0.21 1.80±0.14	0.04* 0.01*
FEV_1(lts)	2.58±0.20 2.10±0.17	1.87±0.15 1.27±0.10	0.012* 0.0002*
FEV_1/FVC	83.46±1.59 81.31±5.2	77.9±1.45 70.13±1.82	0.01* 0.04*
PEFR(lts/sec)	6.01±0.21 4.96±0.21	5.20±0.13 3.70±0.32	0.002* 0.0023*
$FEF_{(25-75\%)}$ (lts/sec)	3.43±0.13 3.10±0.19	2.77±0.16 2.22±0.19	0.003* 0.006*

(p value of <0.05 to be considered significant)

Discussion

The results obtained from this study revealed that the street sweepers are prone to develop lung impairment due to prolonged exposure to dust due to their nature of occupation. In this study we found that all the PFT parameters were significantly reduced among street sweepers when compared to the general population.

FVC and FEV1 were found to be decreased significantly in street sweepers. These parameters can be reduced in both the obstructive and restrictive type of lung diseases. [15]

But FEV1/FVC ratio was found to be less than 80% in male sweepers and less than 71% in female sweepers which indicates development of obstructive pattern of lung impairment .Similar results were obtained in study conducted by Shaik Anwar et al which demonstrated that obstructive pattern of pulmonary impairment developed in non-smoking 100 street sweepers exposed to 8-12 hours/day of sweeping for more than 5 years, with significant decrease FMEF/FVC ratio indicating small airway obstruction .[14] Decrease in FEV1/FVC ratio to less than 80% is seen in obstructive pattern of lung disease whereas the FEV1/FVC ratio is near to normal 80% in restrictive type of lung diseases. [15]

FEF(25-75%),which is an average expiratory flow rate at the mid of forceful expiration, which is a more sensitive indicator of middle and lower airway status was significantly reduced to less than 2.8 (lt/sec) among street sweepers proving as an early marker of smaller airway obstruction in them. PEFR

which is an indicator of large airway obstruction like bronchi was also significantly reduced in street sweepers.

Similar results were obtained in a study conducted in central Karnataka on female sweepers stating,there was statistically significant decrease in FVC , FEV, PEFR , FEF (25-75%)indicating obstructive type of lung impairment. [13]

The chronic prolonged exposure of street dust which is a complex mixture of soil, automobile exhaust particles, plant fragments, animal waste, domestic waste and other biological materials are acting as harmful irritants to the respiratory tract leading to cough and other respiratory symptoms which may further develop irreversible lung impairment. The dust not only effects the larger airways but even the involvement of small airways, which could further worsen with increasing duration of exposure to dust leading to irreversible lung impairment. Dust particles smaller than 1 micron in diameter diffuse in the wall of the alveoli and adhere to alveolar fluid which is then taken up by alveolar macrophages, where the macrophages try to eliminate the minute dust particle from the lungs, but alveolar macrophages also fail to eliminate them as they are chronically getting deposited in larger amount from for longer time.[5-7]

The alveolar macrophages loaded with dust particles release toxic substances in the process of eliminating dust particles, cause inflammation of the surrounding area which later on leads to lung tissue destruction. The tissue injury to the lung if the constant irritant dust destruction can lead to irreversible particle is not expelled out. [3]

As per the PFT results obtained in our study, we can state that street sweepers exposed to dust during sweeping for more than five years develop obstructive pattern of lung impairment due to prolonged chronic exposure to dust as an occupational hazard in them.

Health education and counseling about the hazards of occupations have to be taught to them like importance of wearing a dust proof mask, use of long handled brooms in place of short handled brooms that decreases the distance of exposure of direct dust into their respiratory tract, watering the street prior to sweeping instead of doing dry sweeping. It would be advisable for sweepers to do shift work every 3-4 days/week.

Conclusion: This study reveals that prolonged exposure to dust in street sweepers has resulted in obstructive pattern of lung impairment in them. The outcome from this study will be helpful in understanding the hazards of occupational exposure to dust, so that appropriate preventive and precautionary measures are undertaken to avoid the future morbidity and mortality in street sweepers.

REFERENCES:

1. Park K. Occupational health. In: Park K, editor. Textbook of Preventive and Social Medicine, 23rd ed. Jabalpur: Bhanot Publishers; 2015.p.805-10.
2. Krajewski JA, Tarkowski S, Cyprowski M. Occupational exposure to organic dust associated with municipal waste collection and management. Int J Occup Med Environ Health 2002; 15:289-301.
3. Kasper DL, Braunwald E, Fauci AS, Hauser SL. Environmental lung diseases. In: Harrison's principles of Internal Medicine, 16th ed. New York: The McGraw Hill Companies; 2008.p. 1521-7.
4. Purdue MP, Gold L, Jarvholm B, Alavanja M. Impaired lung function and lung cancer incidence in a cohort of Swedish construction workers. Thorax 2007; 62:51–6.
5. Heldal KK, Eduard W. Associations between acute symptoms and bioaerosol exposure during the collection of household waste. Am J Ind Med 2004;46:253–60.
6. Al Neami YI, Gomes J, LIoyd OL. Respiratory illnesses and ventilatory function among workers at a cement factory in rapidly developing country. J Occup Med 2001; 51:367-73.
7. Kogevinas M, Antó JM, Sunyer J, Tobias A, K. Occupational asthma in Europe and other industrialized areas: a population-based study. European Community Respiratory Health Survey Study Group. Lancet 1999; 353:1750–54.
8. Rao NM, Kashyap SK, Kulkarni PK. Pulmonary function studies in 15-18 years of age workers exposed to dust in industries. Indian. J Physiol Pharmacol 1992;36:51–4.
9. Bechlake MR. Chronic airflow limitation: its relationship to work in dusty occupations. Chest 1985; 88:608–17.
10. Nku CO, Peters EJ, Eshiet AI, Oku O, Osim EE. Lung function, oxygen saturation and symptoms among street sweepers in Calabar-Nigeria. Nigerian Journal of Physiological Sciences 2005; 20:79-84.
11. Wagner NL, Becket WS, Steinberg R. Using spirometry results in occupational medicine and research. Common errors and good practice in statistical analysis and reporting. Indian J Ocup Environ Med 2006; 10:5-10.
12. Hyatt A, Scanlon P, Nakamura M. Introduction and Interpretation of Pulmonary Function Tests, A Practical Guide. 3rded. New Delhi: Wolters Kluwer; 2009. p. 2.
13. Smilee JS, Dhanyakumar G, Vivian ST. Acute Lung Function Response to Dust in Street Sweepers. Journal of Clinical and Diagnostic Research

2013; 7: 2126-9.

14. Shaikh Khurshid Anwar, Naeem Mehmood, .Sweeper's lung disease: a cross-sectional study of an overlooked illness among sweepers of Pakistan. International journal of COPD 2013; 8:193-7.
15. David Bellamy, Rachel Booker, Stephen Connellan,David Halpin.Using a spirometer. In: David Bellamy, editor. Spirometry In Practice - A Practical Guide to Using Spirometry in Primary Care, 2nd ed. London: British Thoracic Society (BTS) COPD Consortium; 2005.p.12-5.