



STUDY OF PULMONARY FUNCTION TESTS IN STREET CLEANERS IN PATNA.

Dr Sujit Kumar

Tutor, Department of Physiology, Nalanda Medical College, Patna.

Dr Rashmi Singh*

Tutor, Department of Community Medicine, Patna Medical College, Patna.
*Corresponding Author

Dr Anil Kumar Singh

Professor & HoD, Department of Physiology, Nalanda Medical College, Patna.

ABSTRACT Street cleaners are exposed to different types of dusts, bio-aerosols and fumes. These have deleterious effect on lung functions. So we carried out this Study to see the effect of these in occupationally exposed persons i.e. Street cleaners (working for more than five years). In this Cross Sectional Study, the study group comprised of 110 Street cleaners (working for more than five years) of which 80 were non-smokers and 30 were smokers and 60 Control subjects of which 30 were non-smokers and 30 were smokers. There was statistically significant decrease in Peak Expiratory Flow Rate (PEFR), Forced Expiratory Volume in first second (FEV1), FEV1/FVC ratio <80% and Forced Expiratory Flow at 25%-75% of volume as percentage of Vital Capacity (FEF 25%-75%). So we found that the occupational exposure of the workers to harmful dust, gases and bio-aerosols leads to obstructive type of impairment of Lung functions.

KEYWORDS : Pulmonary Function Tests, FEV1 ,PEFR , FEF25%-75%, Street Cleaners

INTRODUCTION

Lungs are on a constant threat to entry of noxious sources during respiration. The noxious media which is most common in the environment is dust. Dust consists of solid particles of minerals or organic materials dispersed in air. The Street cleaners are exposed to dust particles, bio-aerosols and various harmful gases. The dust particles and bio-aerosols are either swallowed or coughed out to the exterior but the smaller particles between 1-5 micro-meters settle down in the smaller bronchioles due to gravity. Particles smaller than 1 micron in diameter diffuse in the wall of the alveoli and adhere to alveolar fluid which are then taken up by alveolar macrophages which later on leads to tissue destruction. The study of respiratory mechanics is done by means of Pulmonary Function Tests (PFT) [1]. The main objective of the study was to measure PFT among street cleaners which are exposed to dust, bio-aerosols and various gases and it's comparison with normal subjects and to see the effect of dust, bio-aerosols and gases in causation of Asthma, COPD and other Obstructive changes in the lungs of street cleaners [2,3,4,5].

MATERIAL AND METHODS

This cross-sectional study was done in the Department of Physiology, Nalanda Medical College, Patna.

Inclusion Criteria:

110 street cleaners who were doing cleaning work for the last five years were taken for study group and they were matched with 60 control subjects of same age group (between 18 to 50 years), height, weight and smoking history. There were no drop outs in the Study.

Exclusion Criteria:

Subjects with history of any Upper Respiratory Tract Infection (URTI) within 2 weeks prior to testing or having chronic medical illnesses (Diabetes, Hypertension, Renal diseases, known chronic respiratory ailments etc.) were excluded from the study.

Following parameters were studied:

1. Anthropometry: Age, Height, Weight.
2. Respiratory Parameters: Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV1), FEV1/ FVC % ratio, Peak Expiratory Flow Rate (PEFR), Forced Expiratory Flow at 25%-75% of volume as percentage of Vital Capacity (FEF25%-75%).

Statistical Analysis

Values were recorded as mean \pm S.D. (Standard Deviation) for Statistical evaluation of the data generated. Data was evaluated according to unpaired "t" test using SPSS (Statistical Package for Social Studies) Version 16.0 software. P value < 0.05 was taken to be statistically significant with CI (Confidence Interval) of 95%. All the street cleaners and control subjects were divided into two groups that is smoker and non-smoker. Non-smoker street cleaners were compared with non-smoker control subjects for Lung Functions (Table 1) while

smoker street cleaners were compared with smoker control subjects for Lung Functions (Table 2).

RESULTS

Table 1 shows that non-smoker Street cleaners and non-smoker Control subjects are similar in anthropometric terms like age, height and weight. While there is statistically significant decrease in PEFR, FEV1 and FEF 25% 75% with FVC not decreased significantly among these groups. It means that non-smoker street cleaners who were working for more than five years had developed Obstructive pattern (FEV1/ FVC ratio <80%) impairment of Lung functions. As shown in Table 2 smoker street cleaners and smoker control subjects are similar in term of age, height and weight. There is significant decrease in FEV1 and FEF 25%-75% while FVC is not changed significantly among these two groups. It means that smoker street cleaners who were working for more than last five years had also developed Obstructive pattern (FEV1/ FVC ratio <80%) impairment of Lung functions.

Table 1. Comparison Between Non-smoker Street Cleaners With Non-smoker Control Subjects

	Non-smoker street cleaners (n=80) Mean \pm SD	Non-smoker Control Subjects (n=30) Mean \pm SD	P value
Age (years)	36.06 \pm 8.49	36.50 \pm 8.96	NS
Height (meters)	1.70 \pm 0.04	1.70 \pm 0.05	NS
Weight (kilograms)	62.20 \pm 9.20	61.50 \pm 10.20	NS
FEV1	63.82 \pm 14.79	88.50 \pm 8.80	<0.01*
FVC	85.87 \pm 15.16	86.66 \pm 12.92	NS
FEV1/ FVC	<80%	>80%	\$
PEFR	65.65 \pm 16.22	90.16 \pm 14.30	<0.01*
FEF25% -75%	53.31 \pm 20.20	84.00 \pm 18.20	<0.01*

-Values shown for FEV1, FVC, PEFR, FEF25%-75%, are showing percentage predicted values for that Age, Height & Weight.

-*means statistically significant (p value <0.05) change with CI (Confidence Interval) of 95%.

-NS means Non-Significant change.

-\$ FEV1/ FVC % ratio indicates Obstructive pattern of impaired Lung Functions among Non-Smoker Street cleaners.

Table 2. Comparison Between Smoker Street Cleaners With Smoker Control Subjects

	Smoker Street cleaners (n=30) Mean \pm SD	Smoker Control Subjects (n=30) Mean \pm SD	P value
Age (years)	38.51 \pm 11.78	37.12 \pm 7.25	NS
Height (meters)	1.69 \pm 0.07	1.71 \pm 0.06	NS
Weight (kilograms)	61.20 \pm 19.20	63.30 \pm 20.30	NS
FEV1	59.96 \pm 17.35	78.42 \pm 16.80	<0.01*

FVC	85.00 ± 15.96	84.25 ± 11.20	NS
FEV1/ FVC	<80%	<80%	\$
PEFR	60.90 ± 16.91	60.62 ± 18.22	NS
FEF25%-75%	51.78 ± 19.31	72.30 ± 16.50	<0.01*

- Values shown for FEV1 , FVC , PEFR , FEF25%-75% , are showing percentage predicted values for that Age, Height & Weight.

- *means statistically significant (p value <0.05) change with CI (Confidence Interval) of 95%.

- NS means Non- Significant change .

- \$ FEV1/ FVC % ratio indicates Obstructive pattern of impaired Lung Functions among Smoker street cleaners.

DISCUSSION

In our study, we found a decrease in PEFR, decrease in FEV1 with normal FVC (FEV1/FVC per cent ratio <80%) indicating an Obstructive pattern of impaired Lung Functions among these street cleaners (non-smokers) who were working for more than five years , further a decrease in FEF25%-75% showed that smaller airways were also getting obstructed. These findings are in accordance with the earlier work of Ramaswamy who found significant decrease in pulmonary function parameters PEFR, FVC ,FEV1 in Sweepers as compared to control subjects. They also reported more decline in Pulmonary Function Test parameters with increasing duration of work [6].

Another study conducted in Delhi showed that impairment of Lung Functions in 62% of the Landfill workers employed in disposal of solid waste compared to 27% of the control subjects [7]. Various other authors have found similar decrease in Lung Functions in other Occupationally exposed workers who were exposed to dusts and bio-aerosols etc.[5,8-13]. However a study in Calabar, Nigeria did not find a statistically significant decrease in FVC, FEV1, and PEFR in street cleaners as compared to control subjects [14].

Furthermore in this study we found that the PFT parameters were also decreased in the street cleaners who were chronic smokers and this is consistent with other studies that found that smoking aggravates the dust induced Bronchitis and airway obstruction [15-17]. The street cleaners are exposed to dust particles, bio-aerosols and various harmful gases. The dust and fumes to which a street cleaner happens to be exposed usually accumulate in foci which lie in proximity to respiratory bronchioles and initially may not cause tissue destruction but as a street cleaner remains persistently exposed to dust and fumes for years together it causes first the Obstructive pattern of Lung impairment then the Restrictive or mixed pattern. In our present study, also we found an Obstructive pattern shown by significant decrease in FEV1 along with normal FVC (FEV1/ FVC ratio <80%). Also PEFR showed a significant decrease again showing obstruction of larger airways and the significant decrease in FEF 25%-75% indicates about obstruction of smaller airways too. Thus our study found that dust causes Obstructive pattern of Lung function impairment among street cleaners (working for more than last five years) which is aggravated by smoking. So these street cleaners should take proper preventive measures like use of face mask during cleaning work, use of modern equipment for cleaning work, sprinkling water on the street before doing cleaning work, stopping the smoking etc. And they should undergo regular health check-ups for early detection of Lung Function impairment for better health of this socially underprivileged group.

REFERENCES

1. Standardization of Spirometry, 1994 Update. American Thoracic Society. Am J Respir Crit Care Med 1995; 153(3): 1107-1136.
2. Kogevinas M, Anto JM, Sunyer J, Tobias A, Kromhout H, Burney P. Occupational asthma in Europe and other industrialised areas: a population based study. European Community Respiratory Health Survey Study Group. Lancet 1999; 353(91): 1750-1754.
3. Rao NM, Kashyap SK, Kulkarni PK, Saiyed HN, Purohit AK, Patel BD. Pulmonary function studies in 15-18 years of age workers exposed to dust in industries. Indian J Physiol-Pharmacol 1992; 36(1): 51-54.
4. Bechlake MR. Chronic airflow limitation: its relationship to work in dusty occupations. Chest 1985; 88(4): 608-617.
5. Hameed AAA, Shakour AA and Yasser HI . Evaluation of bio-aerosols at an animal feed manufacturing industry: A case study. Aerobiologia 2003; 19: 89-95.
6. Ramaswamy P, Balakrishnan K, Srinivasan R, Sambandam S, Paulsamy J, Thanasekaran V, et al . Health Hazards and Pulmonary Functions in Solid Waste Management Sector of Chennai. Epidemiology 2007; 18(5): pp S95-S96.
7. Ray MR, Mukherjee G, Roychowdhury S, Lahiri T. Respiratory and general health impairments of ragpickers in India: A study in Delhi. Int Arch Occup Environ Health 2004; 77(8): 595-598.
8. Wang X, Yano E, Nonaka K, Wang M, Wang Z. Respiratory impairments due to dust exposure: a comparative study among workers exposed to silica, asbestos, and coalamine dust. Am J Ind Med 1997; 31(5): 495-502.
9. Marine WM, Gurr D, Jacobsen M: clinically important respiratory effects of dust exposure and smoking in British Coalminers. Am Rev Respir Dis 1988; 137(1): 106-112.
10. Mathur ML, Dixit AK, Laxminarayana J: Correlates of peak expiratory flow rate: A study of sand stone quarry workers in desert. Indian J Physiol Pharmacol 1996; 40(4): 340-344.

11. Dudhmal VB, Afroz S, Jadhav SS, Karadkhedkar SS. Pulmonary function tests in saw mill factory workers. Indian J Physiol Pharmacol 2006; 50(3): 313-315.
12. Ulvestad B, Bakke B, Eduard W, Kongerud J, Lund MB. Cumulative exposure to dust causes accelerated decline in lung function in tunnel workers. Occup Environ Med 2001; 58(10): 663-669.
13. Oxman AD, Muir DC, Shannon HS, Stock SR, Hnizdo E, Lange HJ. Occupational dust exposure and chronic obstructive pulmonary disease: a systemic overview of the evidence. Am Rev Respir Dis 1993; 148(1): 38-48.
14. Nku CO, Peters EJ, Eshiet AI, Oku O, Osim EE. Lung function , oxygen saturation and symptoms among street sweepers in Calabar -Nigeria. Niger J Physiol Sci 2005; 20(1-2): 79-84.
15. Hnizdo E. Combined effect of silica dust and tobacco smoking on mortality from chronic obstructive lung disease in gold miners. Br J Ind Med 1990; 47(10): 656-664.
16. Prokhorov AV, Emmons KM, Pallonen UE , Tosh JY. Respiratory response to cigarette smoking among adolescent smokers : a pilot study. Prev Med 1996; 25(5): 633-640.
17. Rastogi SK, Gupta BN, Husain T, Mathur N, Pangtey BS, Garg N. Respiratory symptoms and ventilatory capacity in metal polishers. Hum Exp Toxicol 1992; 11(6): 466-472.