

Effects of Cement Dust on the Pulmonary Function Indices of Cement Factory Workers in Karachi

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ABSTRACT

Objective: It has been observed that exposure to cement dust has been found to be associated with impaired pulmonary function and lung diseases. Therefore, this study aims to determine the effects of chronic exposure to cement dust on the pulmonary function of cement mill workers (non smokers) and comparing it to non-exposed otherwise matched individuals.

Study Design: Cross sectional study

Place and Duration of Study: the study has been completed in duration of 4 months and the data was collected from a cement factory of Karachi.

Materials and Methods: A cross sectional study was carried out on a sample size of 100 cement mill workers who were divided into two groups of non-smoker exposed (n=46) and non-smoker, non-exposed (n=54) workers and matched for age, height, weight, BMI, duration of work and their PEF_R and FEV₁ were observed using electronic peak flow meter.

Results: It has been found that there was no difference in the age, work experience, height, weight and BMI between the two groups while statistically significant difference was found in FEV₁ between the two groups, while PEF_R was found to be insignificant.

Conclusion: Occupational cement dust exposure is associated with impaired pulmonary functions which may lead to chronic lung diseases in these workers. This justifies the need to take preventive measures.

Key Words: Cement, PEF_R, FEV₁

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INTRODUCTION

Occupational lung diseases arise due to the exposure of an individual to the air born particles which are deposited in the respiratory system through inhalation [1]. For some, there is a clear cut correlation between the exposure and disease and/or impairment in the pulmonary function they cause. There are a vast number of respiratory diseases that are directly or indirectly related to work or occupation, the important of them being asthma, COPD, etc¹. One such occupation where the impact has been observed is cement industry. Impaired pulmonary function in these workers due to exposure to cement dust has been reported by many researches, which showed that the work environment affects the health and normal function of the workers^{2,3}.

Many researchers have associated cement dust as to be the direct and potential cause of the occupational pulmonary disease which causes damage to the protective mechanism³. The production of cement dust during heating a blend of limestone and clay, grinding, packaging and transporting can potentially lead to deposition of the cement dust particles in the tracheo-bronchial respiratory zone, thus leading to the impaired respiratory function and obstructive / restrictive lung diseases^{3,4}. Some researchers have correlated the duration of exposure with the severity of lung function impairment, while few on the other hand also failed to prove such association⁴. Furthermore, continuous exposure to the cement dust particles ranging from 0.05 to less than 10 microns can be accumulated in the terminal airways and alveoli which may cause inflammatory and fibrotic changes in the lungs and may lead to restrictive and obstructive lung diseases³.

It has also been reported that the workers in the developing countries are not being provided with the protective tools or apparatus that could help minimize the exposure to the cement dust. Moreover, they belong to the low socioeconomic group and are not being provided with any training and precautionary

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measures^{4,5}. Chronic exposure to the cement dust can lead to the inflammatory changes in the skin, eyes and respiratory mucous membrane leading to chest tightness, dyspnea, and cough, leading to structural and functional abnormalities particularly affecting the pulmonary system. It has also been reported to cause the colonic carcinoma^{4,5}.

This study aims to determine the effects of chronic exposure to cement dust on the pulmonary function of non smoker cement mill workers and comparing it with those of unexposed, non smoker individuals.

MATERIALS AND METHODS

This cross sectional study was conducted in the city of Karachi, Pakistan. The data was collected from the workers of a private cement factory of the city, who were having a work experience of at least 1 year. Individuals with chronic diseases like COPD, diabetes mellitus, anemia, malignancies, smokers and drug addict were excluded from the study. Those having deformities of vertebral column, thoracic and musculo-skeletal system or who have undergone thoraco abdominal surgeries, chronic exercisers, and those who work in industry other than cement were also excluded from the study. After initial interview, two groups were formed out of a sample size of 100 volunteers, out of which 46 were those who were apparently health, non smoker, exposed mill workers, aged between 20-60 years and worked for 8 hours/ 6 days a week to occasionally 16 hours/ 6 days a week. These were the individuals who were indifferent about using personal protection equipments like masks, goggles, ear muffs, etc. and were in direct contact with the cement dust (case group or exposed group). A similar matched group of 54 non smoker mill workers which included clerical staff, administrative officers, storekeepers and officers who were not directly exposed to the cement dust were also selected as control group. The procedure for lung function test was demonstrated and explained to each individual included in the study and then was carried out using a Electronic Peak Flow Meter. In addition to anthropometric measurements, Force expiratory volume in first second (FEV₁) and Peak expiratory flow rate (PEFR) were measured and compared between the two groups.

RESULTS

All the individuals selected for the study were non smokers and were not taking any protective measures such as mask or any other stuff for prevention from the dust. Both the exposed and non exposed cement factory workers were compared for the anthropometric measurements such as weight, height, BMI, waist circumference, age and their duration of work. All of the parameters were found to be statistically insignificant on comparison between exposed and non exposed factory workers which shows that the

two groups were matched with each other as shown in table 1. When the pulmonary function parameters were compared between the two groups, it was found that PEFR was statistically insignificant while FEV₁ differed significantly between the two groups ($p < 0.05$), as depicted in table 2. Therefore, this difference could be attributed due to the occupational dust exposure.

Table No.1: Comparison of the two groups against various anthropometric variables and job experience

Variables	Exposed (n=46) Mean (SD)	Non- Exposed (n=54) Mean (SD)	P- Value
Weight	75.8 ± 15.3	74.9 ± 12.7	0.75
Height	1.71 ± 0.20	1.69 ± 0.95	0.47
Body Mass Index	26.2 ± 6.17	26.1 ± 5.02	0.95
Waist circumference	36.4 ± 4.78	37.1 ± 3.68	0.37
Age	39.3 ± 9.21	42.1 ± 10.71	0.16
Experience	10.9 ± 2.27	12.1 ± 9.67	0.52

*Significant value $p = 0.05$

Table No.2: PEFR and FEV₁ between the two groups:

Variable	Exposed (n=46) Mean (SD)	Non- Exposed (n=54) Mean (SD)	P- Value
Peak Expiratory Flow (PEF) in ml	454.3 ± 156.1	456.4 ± 119.8	0.94
Force Expiratory Volume in First Second (FEV ₁) in Liters	2.50 ± 0.94	2.14 ± 0.69	0.03*

*Significant value $p < 0.05$

DISCUSSION

The present study demonstrates a significant difference in the FEV₁ value between the exposed and unexposed group, which can be attributed to the occupational environment that affects the dynamic lung volume (FEV₁). This is in consistent with other studies, in which it was demonstrated that there exists a significant difference in FEV₁ in workers who were in close contact with the dust exposure^{3,6}. In addition to this, the change in the lung volume in cement workers has also been demonstrated in other studies conducted in different countries such as Nigeria, UAE, and Saudi Arabia^{7, 8, 9}.

Omer A El Badri reported a reduction in the lung volume increased proportionately with the exposure to cement dust and demonstrated a significant reduction in the PEFR and FEV₁ when compared to unexposed group, which implies to the restrictive lung disease¹⁰. This is in contrast to the present study which shows PEFR to be statistically insignificant while FEV₁ remains significant between the two groups.

Inhalation of the air born dust results in the most important group of occupational disease, i.e. respiratory

tract disorder, of which chronic bronchitis often associated with emphysema has been the most frequently reported¹¹. A Study conducted in Iran indicates that due to the chronic exposure to cement dust, there exists a general tendency for some of the pulmonary function parameters to diminish, thus, leading to a significant decrease in the some of these parameters such as VC, FVC, FEV1 and PEFr¹². This is consistent with present study, although the reduction of PEFr was found to be insignificant while FEV1 remains significant between the exposed and non exposed cement workers. Diminished ventilator capacities due to occupational exposure to cement dust have also been reported with other studies^{9,13-15}. A study conducted in the Norwegian cement factory workers demonstrated an insignificant reduction in the pulmonary functions and attributed this to the vigilant use of protective measures¹⁶. Such practices were also missing in our industries and the current study also showed the absence of the practical implementation of such preventive measures.

CONCLUSION

Occupational cement dust exposure has been found to be associated with impaired pulmonary functions which may lead to chronic pulmonary diseases in future. This justifies the need to ensure that the workers take preventive measures by using protective gears and reducing the accumulation of dust in the environment in order to reduce the inhalation of dust particles. This would ensure safe working environment and may be helpful in preventing the occupational respiratory diseases which could decrease the financial burden not only on the people but also on the government.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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