

# Effects of Cement Dusts on Peak Expiratory Flow Rate (PEFR) in Female Cement Dust Exposed Construction Workers

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## Abstract

### Background:

Occupational and environmental lung diseases are the major problems of clinical medicine. The cement dust workers are constantly exposed to high amounts of visible ambient air particulate matter, mostly without any respiratory protective device. Therefore, the inhalation of dust over periods of time leads to impaired lung functions.

### Objectives:

To observe the effects of cement dust exposure on PEFR in female cement dust workers.

### Methods:

This cross-sectional study was conducted in the Department of Physiology, Rangpur Medical College, Rangpur from July 2016 to June 2017. A total of 60 female subjects aged 20–50 years were selected for the study. Among them, 30 were apparently healthy workers exposed to cement dust, and 30 apparently healthy height, weight & BMI-matched subjects not exposed to cement dust were selected as control from the surrounding community. Their pulmonary functions were studied by measuring PEFR. For statistical analysis, an unpaired 't'-test was performed by computer-based software SPSS-17.0 version for Windows.

### Results:

The mean measured and mean percentage of the predicted value of PEFR was significantly ( $p \leq 0.001$ ) lower in cement dust-exposed female workers (CD- EFW) than the non-exposed female workers (CD-NEFW).

### Conclusion:

From the result of this study, it can be concluded that cement dust (CD) may have harmful effects on some pulmonary functions.

**Keywords:** Cement dust female workers, Spirometric test, Peak expiratory flow rate (PEFR)

## Introduction:

Occupation is the one in which a person not only earns his daily bread but also spends one-third of the average adult life. Health hazards caused due to a particular occupation are yet to gain importance in public health measures.<sup>1</sup> Occupational health is a multidisciplinary health care specialty whose goal is to provide individuals with access to work. Since 1950, the International Labor Organization (ILO) and the World Health Organization (WHO) have shared a definition of occupational health. "Occupational health is the promotion and maintenance of the highest level of physical, mental and social well-being in workers in all occupations through the prevention of ill health, the management of risk and the adaptation of work to people and people in the workplace"<sup>2</sup> Globally, people in developing as well as in developed

countries, are facing increasing risks of respiratory diseases due to the development of industrialization and modernization.<sup>3</sup> Some researchers showed the prevalence of respiratory morbidity among construction workers 22.34% in Europe and 42.3% in India 2016.<sup>3,4</sup> The main job of our lungs is to bring oxygen and carbon dioxide eliminated from the body. The lungs' defenses can be overburdened and weakened by prolonged exposure to dust and fumes. This can damage the lung tissue. Healthy lung tissue is elastic; it can expand and contract. Some lung diseases interfere with the lungs' elastic properties and make the lungs "stiff." Stiff lungs often cause the lung volume to be reduced, which is called lung restriction. Other diseases can cause airway obstruction, a narrowing of the tubes of the lung. Airways obstruction reduces the rate at which air can pass through the

airways. Both lung restriction and airway obstruction can result from overexposure to certain chemicals.<sup>5</sup> Concrete has become an integral part of modern life. Cement is an extremely important construction material used for housing and infrastructure development and a key to the development process.<sup>6</sup> The aerodynamic diameter of cement particles ranges from 0.05 to 5.0 µm. This size is within the size of respirable particles and makes the tracheobronchial respiratory zone the primary target of cement deposition. Hence, cement dust is important as a potential cause of occupational pulmonary disease. Problems may arise with cement dust exposure when one or more protective mechanisms are damaged. If dusty air is breathed continuously and heavily mixing between the inspired and the dead space air cause some dust to reach the terminal airways. The dust tends to accumulate in the alveoli, in the periphery of other lobules, and with the passing time causes inflammatory changes and ultimately fibrosis.<sup>7</sup> In occupational respiratory diseases, spirometry is one of the important diagnostic tools. A spirometer is a device that monitors airflow in and out of a person's lungs. It plays a significant role in diagnosing and prognosis of lung diseases and describes the effects of restriction or obstruction on lung functions. Periodic testing among workers can detect pulmonary diseases in their earlier stages when corrective measures are more likely to be beneficial.<sup>8</sup> A number of studies have demonstrated the effects of cement dust exposure on lung functions.<sup>8,9</sup> On the other hand, there is probably no study regarding the respiratory status of Bangladeshi cement dust construction workers.

So, we planned to estimate the effects of occupational exposure to cement dust in the different construction site female workers by Spirometric measurement of Peak Expiratory Flow Rate (PEFR).

**Methods:**

This cross-sectional study was conducted in the Department of Physiology, Rangpur Medical College, Rangpur from July 2016 to June 2017. Out of total 120,60 apparently healthy non-smoker female workers exposed to cement dust (CD-EW) for at least 6 months, age ranged 20-50 years were taken as study group. They were selected from different construction area of Rangpur city. Another 60 apparently healthy, age and BMI matched female cement dust non-exposed workers (CD-NEW) were also included as for compari-

son. All the subjects belonged to lower socio-economic status. After selection of the subjects, the objectives, perspective, benefits and risk of this study were briefed in detail to the study subjects. An informed written consent was taken from all the participants. Ethical and protocol review committee of Rangpur Medical College approved the study protocol. A detailed medical and family history of all subjects was recorded in a performed questionnaire. Through, physical examination of study subjects were done and documented. Height and weight of the subjects were measured for calculation of BMI. For assessment of lung function, PEFR of all subjects were measured by using a digital spirometer. For statistical analysis, unpaired students 't'- test was performed by computer based software SPSS- 17.0 version for windows.

**Results:**

Demographic data (age and BMI) of all subjects are presented in Table-I showed no statistical difference between cement dust exposed female workers (CD-EFW) & cement dust non- exposed female workers (CD-NEFW).The mean predicted value of PEFR was compared between CD-EFW & CD-NEFW and there was no statistically significant difference between 2 groups. The mean measured value of PEFR were significantly lower (p≤0.001) in CD- EFW, than those of CD- NEFW. The mean percentage of predicted value of PEFR were significantly lower (p≤0.001) in CD- EFW, than those of CD- NEW (Table-II).

**Table-I: Distribution of subjects according to Mean (±SD) age and BMI in both groups**

Parameters	CD – NEFW (n = 30)	CD – EFW (n = 30)	p-value
Age(years) (n = 30)	37.70±2.037 (36.94–38.46)	37.63±1.991 (36.89–38.38)	.898NS
BMI (Kg/m <sup>2</sup> ) (n=30)	22.443±1.3245 (21.94- 22.93)	22.443±1.1965 (22.02 - 22.79)	.912NS

NS= not significant  
 Data are expressed as mean±SD.  
 Statistical analysis was done by unpaired students't' test.  
 n= total number of subjects.  
 CD- NEFW= Cement dust non- exposed female workers.  
 CD- EFW= Cement dust exposed female workers.

**Table-II: Percentage of predicted value of PEFR in both groups.**

Parameter	Value	CD-NEFW (n= 30)	CD-EFW (n= 30)	p-value
PEFR (Liters)	Predicted value	6.7257 ± .24478	6.6574 ± .25665	.296 NS
	Measured value	6.7513 ± .23340	2.9140 ± .39203	.000*
	Percentage of predicted value	100.4000 ± 1.65258	43.7000 ± 6.25410	.000*

NS= not significant, \* = significant

Data are expressed as mean ± SD\*\*\*=  $P \leq 0.001$ .

Statistical analysis was done by unpaired student's 't' test.

N= number of subjects in each group. CD- NEFW= Cement dust non- exposed female workers.

CD- EFW= Cement dust exposed female workers.

### Discussion:

In this study mean measured and percentage of predicted values of PEFR of female cement dust exposed workers were significantly lower than the control subjects ( $p \leq 0.001$ ). This finding is in agreement with that of some other researcher.<sup>4,7-12,14</sup> The aerodynamic diameter of the cement dust ranges from 0.05 to 20  $\mu\text{m}$  which easily deposited in the respiratory tract and irritating of the mucus membranes and increased mucus secretion in the respiratory tract, this hypersecretion of mucus and inflammation of lung parenchyma leads to decreased lung function and predisposing to chronic obstructive and restrictive lung diseases as well as pneumoconiosis and fibrosis of lung resulting in significantly lower PEFR in the cement dust exposed female workers.<sup>8,9,14,15</sup> Person with long time exposed also have high, mean percentage of airway neutrophils and interleukin-1 $\beta$  in induced sputum samples and mean concentrations of IgA.<sup>16</sup>

### Limitations:

The study was conducted in a selected area. So study population might not represent the whole community. Beside this, because of time limitations, the study was conducted with small sample size. Large sample size would have given a better result and the sample also was taken purposively. So there may be chance of bias which could influence the result.

### Conclusion:

Therefore, from this study, it may be concluded that lung function parameter PEFR decreases in non- smoker female cement dust exposed workers. To be more conclusive similar type of study with larger sample size and measurement of

cement dusts concentration of work place for every 6 months are recommended.

**Conflict of interest:** None

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