



Effect of Air Pollution from the Cement Industries in Reference to the Chronic Obstructive Pulmonary Disease (COPD)

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ABSTRACT

The production of cement is a multistage processes that include quarrying, crushing, raw milling, blending, and production of clinker, milling and last packing. People working in cement industries are exposed to a variety of occupational diseases due to dust exposure. Occupational exposure to cement dust has been associated with an increased risk of respiratory diseases especially in workers who are exposed to cement dust for long periods. The major routes of exposure to cement dust are through skin and inhalation. There is noticeable evidence that cement workers are at increased risk of developing respiratory symptoms [1, 2]. Most often chronic obstructive pulmonary disease(COPD) has been reported which requires further investigation [3]. There is contradictory documentation of an association between exposure to cement dust and lung function impairment [3, 4].

Aims: Our study seeks to find the possible relationship between cement exposure and increasing of COPD using the Particulate Matter 10 (PM10) as the indicator. The objective of our study is to provide an analysis of particulate metal emissions and focusses the relationship between exposure to cement dust and respiratory tract obstruction.

Methods and Material: Our study is a prospective study involving workers in cement industry over a period of one year from 2014 to 2015. Total number of patients diagnosed to have COPD during the period of study were 150. Of these 100 males and 50 females were diagnosed as COPD. Pulmonary function test like Spirometry identifies the affected persons with COPD and proves its severity.

Results: Total number of patients diagnosed to have COPD during the period of study was 150. Of these 100 males and 50 females were diagnosed as COPD. The adolescent affected were 35 %(male – 10 % and female -15 %) and old age about 45 % were found. Almost all the persons affected by mild type were reversible to normalcy after inhalation of bronchodilators severe form of COPD response to moderate state. 10% of severe form of COPD died during the period of study.

Conclusions: Cement workers should be aware of the health implications due to cement exposure and seek medical attention in reference to respiratory symptoms.

KEYWORDS : Cement, COPD, spirometry, PM₁₀.

Introduction:

Exposure to cement has been associated with number of different health problems, starting from early transient changes in the respiratory system to impaired pulmonary function, then continuing to restricted activity/reduced performance, followed by emergency department(ED) visits, hospital admissions and finally mortality. People living in areas with more cement industries, are at particular risk of respiratory diseases [5-7].The role of the cement on acute exacerbations of COPD has been a recurrent subject of research for some time. Although the number of people dying as a result of COPD is more than 20 times as many as those dying from asthma (Hansel and Barnes, 2004), less attention has been given to the former medical condition. Many examinations focus typically on hospital admissions or emergency room visits for COPD. Studies looking at daily variation of respiratory symptoms are even less frequent.

Subjects and Methods:

Pulmonary function test (PFT) procedure

PFT was carried out following the guideline of American Thoracic Society (ATS, 1995) using a portable, electronic spirometer (Spirovit SP-1, Schiller, Switzerland) with disposable filters (SP-150), designed for ambulatory pulmonary function measurements. Spirometry measures actual respiratory flow at a precision of 2%, in addition to predicted values based on age, sex, height, weight and race. Trained research scholars did lung function tests. Before performing the PFT, the height and weight of the people were measured. Everyone performed forced expiratory manoeuvres while sitting with free mobility and nose closed with a nose clip to prevent passage of air through the nose. Each spirometric test was repeated 3 times to allow the choice of the best values, and 2 values of FEV1 should not differ by more than 5% according to the ATS criteria. Using a computer assisted quantitative assessment the best manoeuvre for acceptance was determined. The data were compared with predictive values based on age, sex, height and ethnic group. Flow was plotted against volume to display a continuous loop from inspiration to expiration, as the overall shape of the flow volume loop is important for interpreting spirometric results. The following spirometric parameters (absolute and relative values such as ratio of actual and predicted values) were recorded for

analysis: FVC

- Forced expiratory volume at 1 second (FEV1),
- Ratio of FEV1 to FVC (FEV1/FVC),
- Forced expiratory flow at 25-75% (FEF25-75%) or maximal mid-expiratory flow rate (MMFR), which is the average expiration flow rate during the middle 50% of the FVC.
- Peak expiratory flow rate (PEFR) – the peak flow rate during expiration

(i) Diagnosis of functional impairment of the lung

Decrement of lung function detected by spirometry could be generally of two types: Obstructive type and Restrictive types of impairment. In some cases combined (both obstructive and restrictive) type of lung function impairment could be encountered.

(ii) Obstructive type of lung function impairment

In obstructive type of lung function deficits such as emphysema or chronic bronchitis the FEV1 is reduced disproportionately more than the FVC, resulting in an FEV1/FVC ratio less than 70%. Thus, FEV1/FVC <70% diagnoses airway obstruction. Subjects with obstructive lung had a rapid peak expiratory flow but the curve descends more quickly than normal and takes on a concave shape, reflected by a marked decrease in the FEF25-75%. With more severe obstruction, the peak becomes sharper and the expiratory flow rate drops precipitously.

(iii) Restrictive type of lung function impairment

In restrictive lung type of lung function decrement, the FVC is reduced below 80% of predicted value. The shape of the flow volume loop is relatively unaffected in restrictive disease, but the overall size of the curve appears smaller when compared to normal on the same scale.

(iv) Combined type of lung function impairment

In combined type of lung function impairment, both FVC and FEV1/FVC ratio are appreciably decreased. Subjects having this problem had FVC less than 80% of predicted value and FEV1/FVC ratio <70%.

Results:**Lung Function Test:**

Total number of patients diagnosed to have COPD during the period of study was 150. Of these 100 males and 50 females were diagnosed as COPD. We found the male/female ratio as 2:1. The restrictive function of male is 8 and female is 11. The obstructive of male is 82 female is 24. The combine of male and female is 10 and 15 respectively.

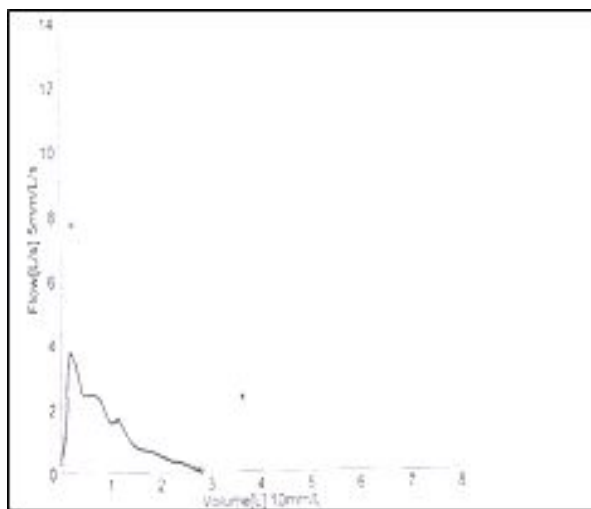
Table-1**Gender difference in the prevalence of lung function deficits in peoples**

Type of deficit	Number of people with percentages in parentheses	
	Male	Female
Restrictive	8	11
Obstructive	82	24
Combined	10	15
Total	100	50

Spirometry result of Moderate Restriction

Name : Kannan Age : 52 years
Sex : Male Weight : 40 Kg
Height : 160 cm

Parameters	Base	Predicted	Minimum observed	% of predicted	Maximum observed	% of predicted
FEV ₁	1.96	2.31	1.57	68	1.63	71
FEV ₆	1.96	-	-	-	-	-
FVC	1.96	2.82	2.73	97	3.24	115
PEF	194	7.74	3.80	49	4.91	63
FEV ₁ /FVC	100	77.8	57.5	74	50.3	65
MEF ₇₅	2.45	6.76	1.74	26	1.76	26
MEF ₅₀	2.73	4.10	0.97	24	0.70	17
MEF ₂₅	3.00	1.48	0.32	22	0.32	22

**Discussion:**

In summary, this study identified and addressed a number of gaps in the existing knowledge on the role of weather, air quality and geographical location on acute exacerbations of COPD. Consequently, our study has been designed to help to address these deficits by examining spatial and temporal variation in acute exacerbations of varied severity of COPD. A Significantly higher incidents of airway limiting disease of COPD more in male. Health hazards associated with chronic exposures to cement are now well recognized. A recent survey found that cement workers were at a higher risk of developing COPD (prevalence of 18.8%) than the administrative workers of the same factory (prevalence of 4.8%), independent of smoking habits [1].

Conclusion: In conclusion, the COPD in cement area study is a unique study aimed at demonstrating the environmental exposures to cement dust are associated with distinct spirometry results. Through this, a more comprehensive understanding of the relative contribution of environmental exposure to COPD features will offer an important platform on which to construct targeted and effective interventions to reduce the burden of disease. The prevalence of chronic respiratory morbidity among workers in cement sector in South India was significantly higher compared to the general population of the country

but lower in comparison to similar workers in other developing countries from Africa and the Middle East. Health related morbidities could be associated to the occupational exposure among workers in the manufacturing sections, who were directly exposed to the cement dust. The duration of the job in the factory, the type of work section and the number of work hours were the important risk factors. Though the study had its focus on respiratory morbidity, a significant proportion of workers had other chronic non communicable diseases including diabetes (37 per cent), hypertension (40 per cent) and cardio-vascular diseases (14 per cent). The morbidities were also higher among the users of tobacco and alcohol, which requires further exploration to ascertain whether this was coping strategy for the nature of stress and discomfort due to the dusty occupation. In addition socioeconomic inequalities in terms of education, income, occupation, rural-urban divide affected the differentials in morbidity among the workers. The poor use or non-use of Personal Protective Equipment was another major risk factor identified that was associated with the morbidity among workers. Non-availability of PPE was mentioned by one third workers. Almost a quarter of the workers in the cement factories had no form of medical check-up in the previous three years in the work site, despite the presence of fully functional hospital in the campuses. These findings point out the existence of infrastructure gaps with weak occupational safety and hygiene standards.

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