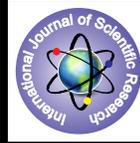


A Study to Assess The Effect of Cement Dust on the Lung Function of Cement Warehouse Workers : A Community-Based Study



Medical Science

KEYWORDS :

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Introduction: Globally, the peoples in developing as well as in developed countries, are facing increasing risks of respiratory diseases due to production of smoke and dust in different occupational and industrial sectors (1). But the health risks due to the inhaled dust particles are influenced by the duration of exposure and the biological responses of the individual person, exerted by the particles. (2) Lung function impairment is the most common occupational respiratory problem in subjects exposed to dust in industrial sectors. (3) Cement industry (manufacturing and storage) is one of the largest industry of the world and its workers are exposed to dust at various manufacturing production and storage processes. (4) Portland cement dust is a mixture of calcium oxide, silicon oxide, aluminum tri oxide, ferric oxide, magnesium oxide, sand and other impurities. (5)

Airborne respirable dust levels from less than 5 to more than 40 mg/m³ have been recorded in the work place air of cement industry workers. The aerodynamic diameter of the cement dust ranges from 0.05 to 20 μm, making the whole respiratory tract a target for cement deposition. (6)

Cement dust particles enter mainly in the body through respiratory tract or the gastrointestinal tract or both by inhalation or swallowing. Al-Neaimi et al. Conducted a study among the workers of the cement factory in the United Arab Emirate, A higher percentage of the exposed workers reported recurrent and prolonged cough, phlegm, wheeze, dyspnea, bronchitis, sinusitis, shortness of breath and bronchial asthma. Vital capacity (VC), forced vital capacity (FVC), forced expiratory volume in 1 s (FEV₁), FEV₁/VC, FEV₁/FVC and peak expiratory flow (PEF) was significantly lower in the exposed workers compared with the unexposed workers. These dust particles also found to effect skin as an irritant, which causes itching, skin allergy, boils, and burn. In experimental animals those who were fed with cement dust for 42 days found that body weight reduction, osteonecrosis, thinning of cortex, and reduction of epiphyseal cartilage. These differences cannot be explained by age, body mass index (BMI) or pack-years smoked (7)

Even in the twenty-first century, millions of people are working daily in a dusty environment. They are exposed to different types of health hazards like fumes, gases, and dust which are risk factors in developing occupational lung diseases.

For variety of reasons, like ignorance or the non-availability of personal protective devices, the workers do not adequately protect themselves through personal protective device. (8)

Objective:

- To detect Prevalence of impaired pulmonary functions
- To correlate their prevalence with the duration of exposure and other risk factors.

Methodology: The present study entitled "A study to assess the effect of Cement dust on the Lung Function of a Cement warehouse workers" was a case control study conducted in the Portland cement warehouse in Bhopal (Near Chola Mandir, Old Bhopal) during December 2010 to March 2011. This warehouse was selected because no previous study has been carried out to assess dust exposure and respiratory health effects at this location which was expected to be representative for the numerous cement warehouse and cement factories in our state. About 150 workers were working regularly in various shifts in which about 80 workers were either severely ill, or history asthma before working in warehouse, or have major systemic illness. Out of 72 workers, 52 workers were included in the studies that are eligible, readily participated by giving consent. Equal number of control was randomly selected from the area, which is at least 10 km away from the warehouse. Controls were matched for age, socioeconomic status, and smoking with the exposed population. Manual spirometry was done as per guidelines and FEV₁, FVC were expressed with reference with age and height adjusted values. FEV₁/FVC ratio of <0.7 (<70%) was considered as airflow limitation.

Study population: 52 workers, aged more than 18 yrs, from cement warehouse and 52 persons from nearby general population (not exposed to cement /cotton dust in past) matched in, age and smoking status with the exposed workers.

Study Period: - Study was undertaken from the month of December 2010 to march 2011 for a period of 4 months.

Inclusion Criteria: Workers irrespective of Smokers and non smokers both were included.

Exclusion Criteria: Three exclusion criteria were taken, the workers who gave history of respiratory and non respiratory problems like allergy, asthma before the employment, severely ill workers and those who refused to give consent.

Sampling Technique –All Workers who fulfill the inclusion and exclusion criteria and were willing to participate in the study were included in study.

Study tool: A structured self administrative questionnaire was developed with the aid of British Medical Research Council questionnaire[X] by the researchers for data collec-

tion to fully meet the demands of this research. The questionnaire had confirmed its validity in several studies with different backgrounds and refers mainly to occupational disease. This tool contained Questionnaire includes the following component demographic profile, duration of exposure, Presence of respiratory, other symptoms and signs due to dust and Use of any protective device while working and Smoking status .

Data collection and Procedure: Due clearance was obtained and after taking departmental permission, the workers were explained the purpose of the study and rapport was built up among them. One to one counseling was used to aware the about health hazards and mask usage. After counseling they were brought to Hamidia hospital, Bhopal to assess their lung functions by Spirometry, in the Department of physiology. Manual spirometry was done as per guidelines and FEV1, FVC were expressed with reference with age and height adjusted values.FEV1/FVC ratio of <0.7(<70%) was considered as airflow limitation. Detected cases by spirometry were advised for physician consultation. Workers with morbidity other then respiratory system were advised for consultation in the concern department.

Result and Observations: All the workers were male so also controls were also taken male. Having age between 18 to 53 yrs (mean age 28.5, SD 9.2s). Most of them were Hindu by religion.

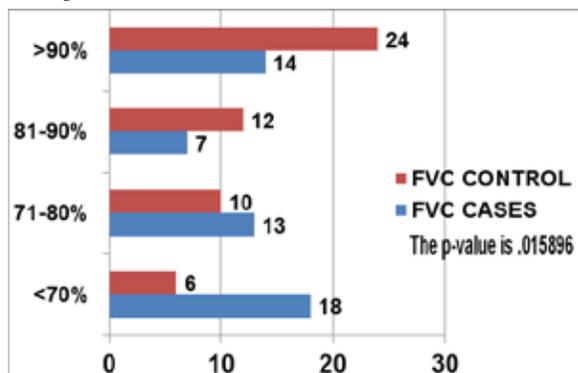
Demographic characteristics of the cement-exposed and un-exposed groups

Group parameters	Exposed (cases)	Unexposed (control)
AGE (yrs)	28 (9.2 SD)	29 (9.3 SD)
Gender	Male-52	Male- 52
HEIGHT(cm)	166±2	165.6±2
WEIGHT(kg)	57±3	57.6±3
Smoking status	Smoker32 Nonsmoker 20	Smoker27 Nonsmoker 25

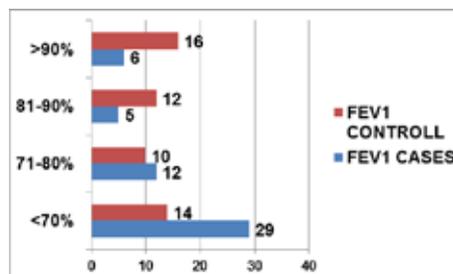
High level of exposure to cement dust-Assessed by duration of working hours (avg. 7hrs)\day and years (avg. 8 yrs.).

No worker in cement warehouse uses any personal protective device (ear plugs, dust masks, shoes, gloves). Chronic respiratory symptoms such as cough present in 88% of cases and 24% of control, sputum was present in 30% of cases and 7% in control, dyspnea was found 34% of cases and 15%of control. In laboratory test of cases their WBCs count was found to be in normal range this shows that their symptoms are not due to the infection.

Graph showing forced vital capacity during Spirometry among cases & controls



Graph showing Forced expiratory volume in 1st second during spirometry of cases and control



P value 0.004991

Table showing relation between type of lung dysfunction with duration of exposure of cement dust (P Value is 0.0258)

Duration	Normal	Obstructive	Restrictive
0 to 5 yrs	14	12	4
6 to 15yrs	3	8	3
>15 yrs	1	2	5

Table showing the maximum workers which are working since 0-5 yrs do not have any lung dysfunction While the workers working >15 yrs are mostly having restrictive type of lung dysfunction and those who are working 6- 15 yrs are mostly have obstructive type of lung dysfunctions.

Odds ratio for restrictive and obstructive dysfunction of lungs :Restrictive dysfunction are 2.82 times higher in cases as compare to control and obstructive dysfunction are 4.71 times higher in cases as compare to control .

As prevalence of pulmonary function is high among those exposed to cement dust as compared to controls this shows that probably prolonged exposure to cement dust has lead to this consequence as all other baseline characteristics were matched like age, smoking status etc.

Majority of cement workers had obstructive type (42.30%).

Proportion of impaired pulmonary function

Cases 65.38 % Control 23.07%

Statistical analysis:-Data were entered into MS excel, analysis was done with the help of Epi-Info-7 software. Frequency and percentage were calculated & statistical test was applied

Conclusions And Recommendation: This study demonstrates reduced lung function and increased prevalence of both acute as well as chronic respiratory symptoms as well among high dust exposed cement handling workers than among the less exposed controls. The study revealed an obstructive pattern in (42.3%) exposed workers on spirometry and a restrictive pattern in (23.07%) exposed workers. The duration of exposure was shown to have significant correlation with lung function measurement among the exposed workers .The prevalence of respiratory symptoms among workers exposed to cement dust in the warehouse studied was with rhinitis, cough, and breathlessness occurring as the most common symptoms. Preventive measures are of paramount importance in minimizing the prevalence of respiratory disorders in the workers. This includes measures aimed at the improvement of working conditions, pre-employment and periodic medical examination of workers.

Discussion : The results of this study show reduced lung capacities and especially airflows in the exposed group in comparison with the unexposed group. In a study in Turkey on 126 workers exposed to tobacco dusts and 55 controls, significant decrease was seen in FEV1, peak expiratory flow rate (PEFR) and maximal mid-expiratory flow (MMEF) in the subjects exposed to tobacco dusts in comparison with the control group.(9) In study of Nagoda, et al also shows that The prevalence of respiratory symptoms was higher in exposed group than in the control group in this study (63% vs 35%), probably due to inhalation of cotton dust in textile factory. And The mean values of PEFR, FVC (3.2 ± 0.24 L) , and FEV1(2.68 ± 0.5) of exposed group were lower than those of the control group.(10)

In our study, there were no significant differences in the major confounding variables of demographic, cigarette smoking between the exposed and unexposed subjects. The levels of inhalable cement dust observed in the current study are higher in exposed ones these findings are similar to other reports , Mwaiselage et al. found such association in a cross-sectional study among 120 exposed and 107 unexposed workers at a Tanzanian cement factory (11). Siyoum et al. designed a study to determine prevalence of respiratory symptoms and associated factors among Cement Factories Workers and compared it with the control group in Ethiopia. The odds of developing respiratory symptoms among . cement factories workers were 7.6 times more than civil servants when adjusted for major confounders (12).

While some of the study shows no significant relation of lung function between exposed group to unexposed group, Kakooei et al. found no statistically significant association between cement dust exposure and respiratory symptoms in a smaller size sample (13). Fell et al. studied 119 cement workers and 50 controls in Norway and also did not find an association between health outcomes (increased respiratory symptoms and decreased pulmonary function) and cement dust (14) . These different results could be explained by the difference of various races, exposure to dusts, duration of employment, genetic variations, accuracy of completing the questionnaire and use of personal protective equipments.

The lung function parameters FVC, FEV1 and FEV1% are lower in value among exposed workers compared with unexposed workers, . This is consistent with the finding of Rasmussen et al (15). who did not find significant differences in lung function between cement factory workers (N = 301) and other blue collar workers (N = 649). Fell et al(8) Found that the mean pulmonary function indices were similar for cement mill workers and the control group (selected p from an ammonia producing industry).

Based on the duration of exposure, cement mill workers were divided into 3 groups, less than 5, 5–10 and greater than 10 years. Their results showed a significant decrease in FVC and FEV1 with increased duration of occupational exposure to cement dust, clearly for more than 10 years of exposure. Also in our study, FEV1/FVC and FEF25–75% had a reverse relationship with the length of employment.

We cannot be sure that there is no exposure among the control workers, while they carried out personal dust monitoring for respirable dusts and reported 0.00 mg/m³ dust exposure among the control group. Also our results may have been influenced by some other limitations. Individuals susceptible to adverse respiratory effects from cement dust may have changed their task and therefore dropped out of the exposed group. Finally, lung function tests were performed during the working day that could

cause a cross-shift effect of the cement dust in some workers. Yet, we believe that the validity of our findings is strengthened by the elimination of the effect of confounding variables, accessing to workers' pre-employment examinations to make assure they did not have previous respiratory diseases and the carefully chosen controls.. A more detailed respiratory hazard assessment in the cement factory is proposed as a future study.

Limitation: 1. Due to economic constraint and relatively short time we could not investigate any long-term variability in dust exposure.

2.We used actual measured values and did not compare to reference populations since predicted values from a representative Ethiopian population was not available.

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