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ORIGINAL RESEARCH

Monitoring of pulmonary function in people dwelling and working in and near cement factory area

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Abstract

Indian cement industry is the second largest in the world. With growing industrialization more and more people are involved in industrial occupation, who are prone to serious health hazards. In the present study we focus on pulmonary function tests (PFT) the changed values correlating with the duration of stay and type of occupation in the cement factory area. A base line demographic and patient data of work and stay was taken with the help of questionnaires designed as data collection form. Patients were sent for pulmonary function test which was done by an experienced PFT technician. Mean age of study subjects was found out to be 40.54 years (± 8.91). The different occupations of subjects staying in the said areas can be summarized as 8 house wives, 22 technicians, 4 hospital workers, 6 mine workers, 6 security personnel and 3 drivers. Mean duration of work and stay was found out to be 13.08 years (± 10.55) and 16.78 years (± 13.32) respectively. The mean forced expiratory volume in the first second (FEV1) was found out to be 71.28 (± 20.74) whereas peak expiratory flow rate (PEFR) was found to be 68.1 (± 17.20). 6 subjects had a history of asthma, 13 had dust allergy, 18 had shortness of breath functional class (FC) - grade III, and 2 patients working in mines had silicosis. There was a negative correlation between duration of stay and FEV1, PEFR with a co-efficient of correlation being -0.4 (p-value 0.29) & -0.43 (p-value 0.1) also the duration of work and FEV1, PEFR with a co-efficient of correlation being -0.51 (p-value 0.4) & -0.3 (p-value 0.7).

Key words: Cement factory; pulmonary function tests; forced expiratory volume; peak expiratory flow rate; occupational lung diseases.

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Introduction

The number of people working in industrial environments on a daily basis remains alarming, in spite of the advances in technology and knowledge of associated occupational health hazards associated in the twenty-first century.

Many types of occupations are associated with health hazards, and the lungs are among the most vulnerable parts of the body to airborne threats. Exposure to some substances can lead to occupational lung diseases and in some cases lung cancer. Occupational workers especially at risk are: coal miners, farmers, asbestos workers, workers with epoxy resins or isocyanates. Other jobs associated

with an increased risk of occupational lung disease include construction, carpentry baking, soldering, laboratory work, hairdressing, bird breeding, milling, drug manufacture, nursing, food processing, textiles, forestry, and horticulture metalworking.

The amount of dust generated in the production of cement is enormous irrespective of the types which are mainly natural and artificial (Portland) cement. Consequently workers at every stage of the process are exposed to the hazard of inhalation of the precipitate dust, fumes and even gas that may be generated [1].

Indian cement industry is the second largest in the world [2]. With growing industrialization more and more people are involved in industrial occupation who are prone to serious health hazards. The most frequently reported clinical features in cement workers are respiratory symptoms and disorders such as rhinitis, chronic cough and phlegm production, chest tightness, wheezing, obstructive and restrictive lung diseases and impairment of lung function. Other non-malignant manifestations include extra pulmonary features like skin irritation, conjunctivitis, abdominal pain, headache and fatigue, while adenocarcinoma of the nasopharynx, carcinoma of lung, stomach and colon are some of the malignant diseases associated with occupational cement dust exposure [3, 4].

Forced expiratory volume in the first second (FEV1) and forced vital capacity (FVC) values from pulmonary function test have a normal range of greater than or equal to 80%. Restrictive lung diseases can cause the FVC to be abnormal. This means that the lung is restricted from filling to its normal capacity of air. Abnormalities of the FEV1 and FEV1/FVC are the result of a decrease in the airflow through the lung, which may be caused by obstructive lung diseases [5].

In this study we focus on the changed pulmonary function test (PFT) values in correlation with the duration of stay and type of occupation in the cement factory area.

Materials and method

Study site chosen was cement factory in Anathapur district in Andhra Pradesh state. A health care program was conducted by KIMS hospital, Secunderabad, Telangana, in the housing society of cement factory. Patients coming to pulmonology OPD were identified, included in the study based on inclusion criteria i.e worked in the cement factory area at least for 2 years and informed consent was taken. Patients who were not willing to sign the consent form, those who smoke and suffered from TB previously were not included in the study. A base line demographic data which included age, sex, details of work and stay was taken with the help of questionnaires designed as data collection form. Patients were sent for pulmonary function test which was done by an experienced PFT technician. The study design would be cross sectional observational study.

Results

All 50 questionnaires were retrieved from the respondents satisfactorily. Mean age of study subjects was found to be 40.54 years (± 8.91). 38 of them were male and 12 of them were female. The occupation of the subjects can be summarized as 8 housewives, 22 technicians, 4 hospital workers, 6 mine workers, 6 security personnel and 3 drivers. Mean duration of stay and work was found out to be 16.78 years (± 13.32) and 13.08 years (± 10.55) respectively. All the subjects were residing or working with in the 5 km square area. The mean FEV1 was found out to be as 71.28 (± 20.74) whereas peak expiratory flow rate (PEFR) was found to be 68.1 (± 17.20). The mean FEV1 and PEFR of subjects of different occupations were summarized in Tables 1, 2 & 3 and indicated in the Figure 1, 2, and 3. Six subjects had a history of asthma, 13 had dust allergy, 18 had shortness of breath fc- grade III and 2 patients working in mines had silicosis.

There was a negative correlation between duration of stay and FEV1, PEFR with a co-efficient of

Table 1: Shows the mean ± standard deviation of various parameters

Mean Age	***40.54 years (± 8.91)***
Male	38
Female	12
Mean duration of stay	16.78 years (± 13.32)
Mean duration of work	13.08 years (± 10.55)
Mean FEV1	71.28 (± 20.74)
Mean PEFR	68.1 (± 17.20)

Table 2: Shows the summary of medical condition of patients.

Medical condition	*N*	*Percentage*
Asthma	6	12%
Dust allergy	13	26%
Shortness of Breath	18	36%
Silicosis	2	4%

Table 3: Shows the values of FEV1 and PEFR of patients of different occupation.

Occupation	*FEV1*	*PEFR*
House wife (n= 8)	81.8	71.5
Technician (n= 22)	69.8	68.18
Hospital staff (n= 4)	75	64.25
Mine worker (n= 6)	68.8	70
Driver (n= 3)	80.6	79.6
Security (n= 6)	59.3	60.6

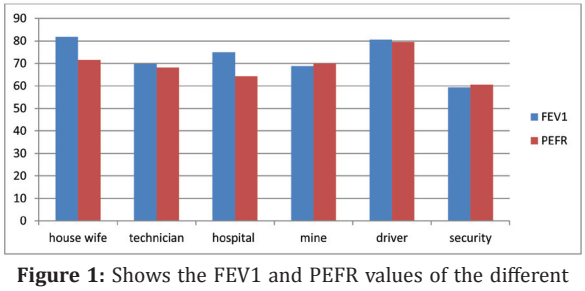

Figure 1: Shows the FEV1 and PEFR values of the different occupational groups in cement factory.

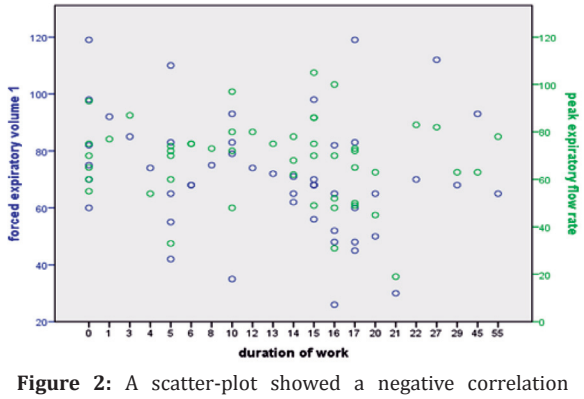

Figure 2: A scatter-plot showed a negative correlation between duration of work and FEV1, PEFR.

correlation being -0.4 (p-value 0.29) & -0.43 (p-value 0.1) also the duration of work and FEV1, PEFR with a co-efficient of correlation being -0.51 (p-value 0.4) & -0.3 (p-value 0.7).

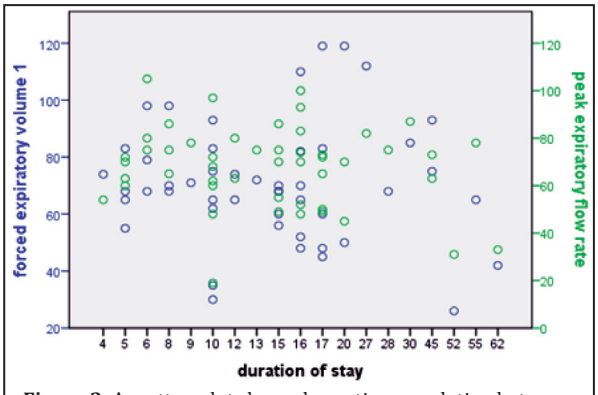

Figure 3: A scatter-plot showed negative correlation between duration of stay and FEV1, PEFR.

Discussion

Khalida Shaikh et al. conducted a study in cement factory workers in Hyderabad, Pakistan and concluded the peak expiratory flow rate was decreased in cement factory workers [6]. Julius Mwaiselage et al. conducted a study in cement factory workers in Tanzania and came to a conclusion that the observed acute respiratory health effects among the workers are most likely due to exposure to high concentrations of irritant cement dust [7]. Zeyede K Zeleke et al. conducted the study in Dire Dawa cement factory in Ethiopia Total cement and reported that dust exposure was related to acute respiratory symptoms and acute ventilatory effects [8]. Anand S conducted the study among the workers of cement industry in South India and he found that working in dusty sections of the unit, more than 25 years of work experience and greater hours [>36] of weekly work were significantly associated with severe lung abnormalities [9].

This study results imply that 39 (78%) out of 50 subjects had problems which include asthma, dust allergy, shortness of breath, silicosis with a mean duration of stay being 16.78 years. As the people working in the outdoors have maximum exposure to cement dust they have the reduced values of FEV1, PEFR. As seen from the table 3 security personnel showed the lowest PFT values, and values being normal in people living or working indoors as seen in drivers and house wives. SPSS was used to calculate the correlation between duration of stay and length of work with both PFT values. The co-efficient of correlation were being -0.4 (p-value 0.29), -0.43 (p-value 0.1) for duration of stay, and -0.51 (p-value 0.4), -0.3 (p-value 0.7) for duration of work with the associated FEV1, PEFR values respectively. This

shows as the length of stay in cement factory area increases there is a decrease in PFT values but the p-value not being significant enough to conclude the hypothesis.

Conclusion

There is a high risk of respiratory problems in people living and working near cement factory. There shows a negative correlation between duration of stay and length of work with the PFT values. As a result, as the duration of stay and length of work increase PFT values decrease this implies effect on lung function. The sample size being small required p-value couldn't be established. Further studies with larger sample are required to conclude the hypothesis. Also regular monitoring of PFT of factory workers should be done.

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Conflict of Interest

The authors declare no conflict of interest.

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