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A COMPARATIVE STUDY OF PEAK EXPIRATORY FLOW RATE AND ABSOLUTE EOSINOPHIL COUNT AMONG WORKERS OF CEMENT INDUSTRY AT GUWAHATI CITY.

Physiology

Dr. (MRS) Reeta Baishya* Professor and Head, Department of Physiology, Gauhati Medical College, Guwahati, Assam, India *Corresponding Author

Dr. Bijit Dutta Post Graduate Trainee, Department of Physiology, Gauhati Medical College, Guwahati, Assam, India

Dr Dhiren Saharia MD Pathology,

ABSTRACT

Background: The study aims is to determine any relationship between the peak expiratory flow rate and absolute eosinophil count among the cement workers and the non cement workers not exposed to cement in the Guwahati city.

Methods: Peak expiratory flow rate were obtained from 30 cement dust exposed male workers and 30 non cement male workers between 20-40 years using Medspiror (HELIOS) digital spirometer in the department of Physiology, Gauhati Medical College, Guwahati, Assam and absolute eosinophil count were done by collection of blood samples in EDTA test tube in a improved Neubauer's chamber. Statistical analysis was done as Mean±standard deviation.

Results: It was observed that PEFR showed a significant decrease value and Absolute eosinophil count showed a significant increase value among the cement workers.

Conclusions: Cement exposure can lead to respiratory diseases associated with eosinophilia.

KEYWORDS

Peak expiratory flow rate, Absolute eosinophil count, Age 20-40 years, Cement dust particles.

INTRODUCTION:

Respiratory diseases related to inhalation of airborne dust are the most important determinant of occupational hazards. The Global risk factors have identified occupational risks to be the tenth leading cause of morbidity and mortality in the world.[14,15] Chronic Obstructive Pulmonary disease especially Chronic Bronchitis and Emphysema has been related with increased risk with cement exposure.[10] India is the second largest producer of cement and its Cement production capacity has reached nearly 420 million tonnes, as of July 2017 and is expected to reach 550 million tonnes by 2025.[3]Portland Cement is the most common constituent in the cement industry and its dust with its individual components like calcium carbonate, calcium silicate and crystalline silica is regarded as a chemical hazard by National Institute of occupational Safety And Health of United States of America.[11]

Studies reveal that exposure to cement dust leads to impairment of lung function. The dust particles of the cement mainly irritate the skin, mucous membrane of the eyes and the respiratory system. [9,16] Studies suggests that acute exposure of cement dust which leads to development of acute respiratory health effects are probably due to higher concentration of cement dust.[8] Studies also reveal that long exposure to cement dust induces mutagenic effects in humans. They concluded that significant increase occurs in the incidence of chromosomal aberrations in those exposed to the cement dust and it was more pronounced when combined with smoking.[4]A study showing higher prevalence rates of recurrent and prolonged cough(30%),phlegm (25%),wheeze(8%),dyspnoea(21%),bronchitis (13%), sinusitis(27%),shortness of breath (8%) and bronchial asthma (6%) thus confirming furthermore higher percentage of respiratory symptoms and decreased lung function in cement workers.[1]Thus with increasing trend of the respiratory diseases in the workers exposed to cement dust in the developing countries this study aims to determine any relationship between the peak expiratory flow rate and absolute eosinophil count among the cement workers and the workers not exposed to cement in the Guwahati city.

MATERIALS AND METHODS:

The study was conducted in the Department of Physiology, Gauhati Medical College, Guwahati, Assam, India. Study was performed after obtaining full consent from them and was done between 9 am to 12 noon to rule out any diurnal variations. Thirty (30) healthy male non cement workers between 20-40 years were selected by simple random sampling from Guwahati city. 30 male cement workers were also selected of the same group from a cement factory of Guwahati city.

Material used was Medspiror (HELIOS) digital spirometer, Microscope, Improved Neubauer slides, WBC pipette and Pilot fluid.

EXCLUSION CRITERIA:

1) All female individuals
2) Male individuals below 20 and above 40 years
3) Individuals having history of Obstructive lung diseases like bronchial asthma, emphysema and Restrictive lung diseases like pneumoconiosis.
4) Hypertensives and Diabetics.
5) All smokers
6) Individuals working in the cement factories for less than 1 year.

Method: For Peak expiratory flow rate the test module was activated and the subjects were given proper instructions about the procedure to be performed. It was done in comfortably upright standing position. Subjects were asked to inhale as deeply as they could and then their nostrils were closed. The mouthpiece was placed snugly in their mouth and blows out as forcibly and as fast as they could into the mouthpiece and their forced vital capacity noted. Tests were repeated three times and best results were considered for analysis.

For Absolute Eosinophil count blood samples were drawn from anti cubetal vein in 5cc disposable syringe and transferred to a sterile glass test tube containing EDTA as an anti coagulant. Blood was sucked by the WBC pipette exactly up to 0.5 mark and the tip of the pipette cleaned. Then Pilot's fluid is sucked up to the 11 mark kept in a clean watch glass, after that the pipette was shaked well for 2-3 minutes to mix the blood thoroughly with the diluting fluid and the pipette was kept for 15 minutes under the cover of a petridish lined with moist filter paper. There after it was shaken again and Neubauer's chamber was charged after discarding 2-3 drops of solution from the pipette. Cells were allowed to settle for 2 minutes and eosinophils stained by phloxine were counted in all four WBC squares under high power objective of microscope and calculation done as; since dilution of the solution is 1 in 20 therefore the number of eosinophils per cubic millimeter of blood will be 50 times the total number of cells counted.

RESULTS:

The mean age for non cement workers were 33.03±3.8 years and for Cement workers were 31.5±4.2 years with p-value of 0.14. The mean peak expiratory flow rate of the 30 non cement workers was 6.8±1.11litres/sec and the mean absolute eosinophil count was 140.9±53.5 cells/cumm and among the 30 cement workers their mean peak expiratory flow rate was 5.3±1.69 litres/sec and the mean absolute eosinophil count was 253.8±58.7 cells/cumm respectively. On statistical analysis it was observed that the mean expiratory flow rate of the Cement workers showed a significant decrease than the non cement workers with P-value <0.05. It was also observed that the mean absolute eosinophil count of the Cement workers showed a highly

significant increase as compared to the non cement workers with P-value <0.01.

TABLE 1- AGE DISTRIBUTION OF NON CEMENT WORKERS AND CEMENT WORKERS

Parameters	Non Cement workers (Mean±std)	Cement workers (Mean±std)	p-value
Age (years)	33.03± 3.8	31.5 ± 4.2	0.14

TABLE 2- PEFR AMONG CEMENT WORKERS AND NON CEMENT WORKERS

Parameters	Cement workers (Mean±std)	Non Cement workers (Mean±std)	p-value
PEFR (litres/sec)	5.3± 1.69	6.8 ±1.11	< 0.05*

***Unpaired t-test; p-value <0.05 =significant**

TABLE 3- ABSOLUTE EOSINOPHIL COUNT AMONG CEMENT WORKERS AND NON CEMENT WORKERS

Parameters	Cement workers (Mean±std)	Non Cement workers (Mean±std)	p-value
AEC(cells/cumm)	253.8±58.7	140.9±53.5	<0.01*

* Unpaired t-test; p-value <0.01 =highly significant

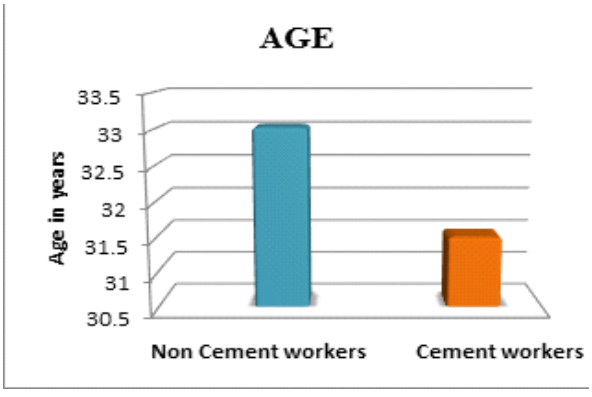

FIGURE 1: DISTRIBUTION OF AGE AMONG OFFICE AND CEMENT WORKERS

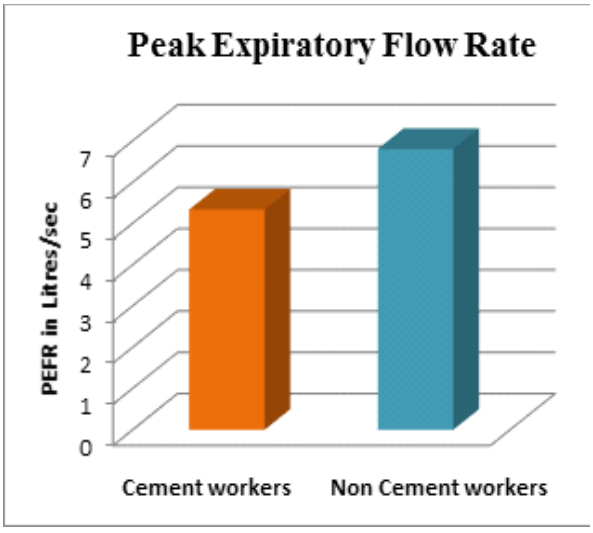

FIGURE 2: DISTRIBUTION OF PEFR AMONG TWO DIFFERENT STUDY GROUPS

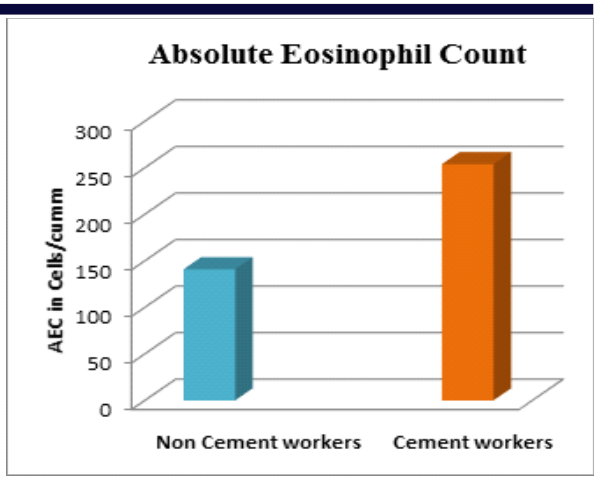

FIGURE 3: DISTRIBUTION OF AEC AMONG TWO DIFFERENT STUDY GROUPS

DISCUSSION:

The peak expiratory flow rate and absolute eosinophil count were studied and compared among the cement industry workers and non cement workers of Guwahati city. We observed that the peak expiratory flow rate among the cement workers were significantly low which also correlated with other studies.[6,13,16] Study showing higher prevalence rates of recurrent and prolonged cough, phlegm, dyspnoea, bronchitis, shortness of breath and bronchial asthma with cement dust exposure were observed further correlating the role of cement with respiratory impairments.[1]The cement dust particles accumulate in the upper and lower airways of the tracheo-bronchial region of the lungs resulting in shortness of breath and coughing. Interaction between cement dust particles and the mast cell or basophil surface results in their degranulation and release of a variety of pharmacological active agents, including histamine and serotonin; the effect of these amines on tissues such as bronchial smooth muscles and vascular endothelium produces many of the symptoms of atopic conditions observed.[2] Bioaccumulation of some specific components as chromium and silica present in the cement dust in the respiratory tract may lead to delayed hypersensitivity reaction and chronic inflammation and hence impaired respiratory function.[12] We also observed that the absolute eosinophil count of the cement workers were significantly increased which correlates with the study done by Mandal et al.[7] This increase in eosinophil count is showed to be associated with allergic responses that contribute to the respiratory diseases.[5]

CONCLUSION & FUTURE SCOPE:

Occupational hazards like cement dust are a growing concern in this industrialized world. Lung function parameters along with hematological investigations are an important tool for monitoring the health of the cement workers and should be performed at regular intervals. India is a country of different ethnic groups which should be taken into consideration and studies with a larger sample size relating to it should be done to observe the variations seen among them.

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