

Effects of Exposure of Cement Dust on Platelet Count in Workers of a Cement Mill

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Abstract

Introduction: Cement dust is emitted during the different steps of cement production. This dust is composed of chemical components that may have unfavourable effects on the haematological system. The workers in these factories are exposed daily to this toxic dust. Those exposed to the cement dust may suffer from changes in platelet count and eventually suffer from damaging effects on the cardiovascular system. **Objective:** Assess the effects of cement dust on platelet count of cement mill workers. **Materials and Methods:** Conduction of this cross sectional study took place in the Department of Physiology, Dhaka Medical College, Dhaka between July 2017 to June 2018. After fulfilling the ethical consideration, 46 apparently healthy male cement mill workers, working for 2 or more years in a cement mill, with range of age of 20 to 50 years (study group) and 46 BMI, age and socioeconomic condition matched apparently healthy male subjects from Dhaka city were control group. The platelet count was estimated using automated haematology analyzer in Dhaka Medical College Hospital, Dhaka. Data was collected in a pre-designed structured questionnaire form. Unpaired Student's 't' test and Pearson's correlation coefficient test were performed for statistical analysis. **Results:** In this study, the platelet count was significantly ($p < 0.05$) higher than those of control group. The platelet count was directly related with duration of cement dust exposure. **Conclusions:** This study concludes that the cement dust has harmful effect on the platelet count and the duration of exposure to cement dust also has an effect on this parameter.

Keywords: Cement dust, Thrombocytosis.

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Introduction:

Dust is classified as mineral dust which includes dusts containing free crystalline silica, cement dust; metallic dust such as lead, cadmium, nickel and beryllium; other chemical dust like many bulk chemicals, pesticides and organic dusts such as flour, wood, cotton and tea dust¹. The major components of cement dust generated from the process of grinding are calcium oxide, silicon dioxide, aluminium oxide, iron oxide^{2,3}. Exposure to this dust may lead to damaging effects to biological systems, tissues and organ. Harmful effects like dermatitis, laryngeal cancer, lung cancer, Gastrointestinal tumour have been reported in cement dust exposed individuals^{4,5}. Silicon oxide (SiO₂) is commonly found in nature as quartz. There are many crystalline forms of silica and alpha quartz is the most common form among them. Exposure to respirable crystalline silica occurs when materials containing crystalline silica are reduced to dust⁶. Chronic exposure to inhaled crystalline silica result in production of reactive oxygen species and enhanced inflammatory cytokine production, lipid peroxidation^{7,8,9}. Inflammation causes release of factors like Tumour Necrosis Factor alpha that may stimulate increased production of platelets from the bone marrow¹⁰. Several studies in different countries like Nigeria, India have indicated that cement dust exposure causes haematological changes that include Platelet count. A raised Platelet count may result in increased risk of cardiovascular disease in cement dust exposed workers. Previous studies in different countries have shown changes in the platelet count in cement factory workers^{11,12,13}. However, in Bangladesh, data is not adequate on this topic. The present study is designed to evaluate the effects of cement dust on platelet count of cement factory workers.

Materials and Methods:

This cross sectional study was conducted in the Department of Physiology, Dhaka Medical College, Dhaka from July 2017 to June 2018. Forty six

apparently healthy male cement factory workers, working in a cement factory for 2 years or more, with age ranging from 20 to 50 years were study group and forty six age, BMI and socioeconomic condition matched apparently healthy male subjects from different areas of Dhaka city were control group based on the inclusion and exclusion criteria. Subjects with history of respiratory disease, acute infection, cardiac disease, haematological disease, liver disease, renal disease, malignancies, hypertension; history of taking anticoagulant, chemotherapy, iron therapy and recent history of blood transfusion were excluded from the study.

After selection of the subjects informed written consent was taken from them. The research work was carried out after obtaining ethical clearance Ethical Review Committee of Dhaka Medical College, Dhaka. All the information were recorded in a pre-designed schedule. With aseptic precaution, 2 ml of venous blood were collected from ante-cubital vein, the blood sample was taken in a tube with EDTA anticoagulant for determination of platelet count. This parameter was determined using Horiba Pentra DX Nexus automated haematology analyzer. The collected blood sample was analyzed in the Department of Laboratory Medicine, Dhaka Medical College hospital, Dhaka. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) Version 16. Data were presented as mean and standard deviation (mean±SD). Unpaired Student's 't' test was done to compare between the groups and correlation was analyzed by Pearson's correlation co-efficient (r) test. p value of < 0.05 was taken as level of significance.

Results:

In this study no statistical differences were observed in age, BMI, socioeconomic condition, systolic and diastolic blood pressure (Table I).

Table- I: General characteristics of the subjects in both groups (N=92).

	Cement mill workers (n=46)	Control (n=46)
Age (years)	33.17± 8.27 ^{ns}	33.52± 7.87
BMI (kg/m ²)	23.14± 2.06 ^{ns}	23.71 ± 2.61
Socioeconomic condition		
Low	46 (100%)	46 (100%)
Systolic BP (mmHg)	117.72 ± 15.06 ^{ns}	113.04± 12.09
Diastolic BP (mmHg)	71.74 ± 9.51 ^{ns}	70.87± 9.11

Data shown as Mean ± SE, Statistical analysis was done by Unpaired Student's 't' test, ns = not significant, Control=Healthy adult subjects not exposed to cement dust, BMI=Body mass index, BP= blood pressure.

The platelet count was significantly higher in the cement dust exposed subjects in comparison to the control group (Table II, Figure 1).

Table-II: Study parameters of the subjects in both groups (N=92).

Parameters	Cement factory workers (n=46)	Control (n=46)
Platelet count (×10 ³ / μl) ^a	297.30 ± 92.65***	234.22 ± 61.76

Data were shown as mean± SE .Statistical analysis was done by Unpaired Student's 't' test (a) for comparison between groups. N= total number of subjects. * = Total count of Platelet of cement mill workers vs control group , *** = p < 0.001 , n= number of subjects in each group.

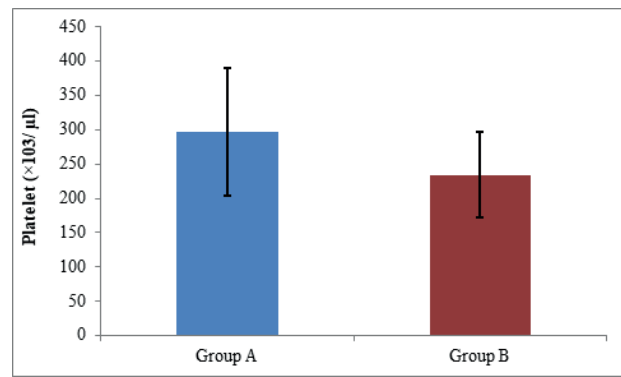


Figure-1: Mean total count of platelet in both groups (N=92).

Group A: Cement mill workers

Group B: Healthy control subjects.

N= Total number of subjects

The change in platelet count showed positive correlation with the duration of cement dust exposure (Figure 2).

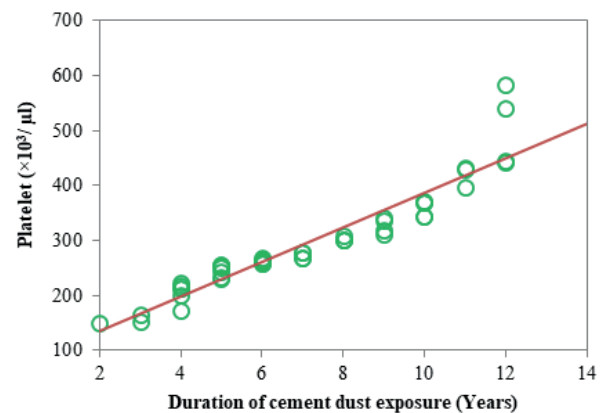


Figure-2: Correlation of duration of cement dust exposure with platelet counts in study group (n=46).

n = number of subjects in study group

Study subjects: Cement mill workers

r = + 0.943, p = <0.001***

Discussion:

In the present study, the platelet count was higher in subjects exposed to cement dust than that of controls and there was positive correlation between the platelet count with the duration of exposure to cement dust. This result is similar to others^{11,12,13}. Literature review suggested cement dust when inhaled cause neutrophils, macrophage and lymphocytes to increase in the lung and also the very small cement dust particle can enter the circulation^{14,15,16}.

Toxic components of cement dust causes alveolar epithelial cells, neutrophils, alveolar macrophage to release inflammatory mediators and cytokines such as tumor necrosis factor-alpha (TNF- alpha), interleukins (IL-1, IL-8). The inflammatory response is accelerated due to these transcription factors^{17,18}.

Transcription factors of GATA family that is, GATA-2 along with GATA cofactor (FOG 1) are involved in regulation megakaryopoiesis in the bone marrow. GATA-2 ensures

maintenance and proliferation of haematopoietic progenitor cells. Increased expression of GATA-2 results in megakaryocytic differentiation.

TNF alpha released by alveolar macrophage due to exposure to cement dust, result in activation of GATA-2 .Overexpression of GATA-2 stimulates megakaryopoiesis. This may result in increase in platelet count^{19,20} .

Conclusion:

After analyzing the results of the study, it can be concluded that cement dust exposure has damaging effect on the platelet count. This is evidenced by significant increase in platelet count in cement dust exposed subjects. The change in platelet count is significantly related to the duration of exposure.

Conflict of Interest: None.

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