

Study of Repeated Susceptibility to Cement Dirt Exposure and its Persistent Consequences on Platelet Count Among Male Cement Handlers At Dalmia Bharat Cement Plant

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Abstract

Background: According to the current study, cement male handlers at Dalmia Bharat Cement Plant had persistent effects of toxic cement dirt exposure on their platelet count. The study found that repeated and protracted exposure, depending on sensitivity and duration; have led to environmental health risks, detrimental health conditions, unfavorable effect on hematological function marker specifically platelet count..

Materials and Methods: The study involved a total of 120 participants. Among participants, 60 were workers directly exposed to cement dirt, referred to as Cement Handlers (CH), due to their job responsibilities over the past eight years. The remaining 60 participants, who had no exposure to cement dirt, served as controls and were classified as Non-Cement Handlers (NCH), consisting of office staff within the same factory. The participants had been employed in the cement industry for an average of 94.15 months (± 3.85 months), which is approximately 7.85 years. Cement handlers were susceptible to cement dirt for about 8 hours each day, weekly 6 days. Blood specimens were collected by paramedical staff at the plant and were transferred to vacationers and quickly sent to a clinical hematological laboratory for analysis, where platelet count in whole blood was determined.

Results: Results of current study unveiled environmental pollution mediated occupational health risk that had been significantly associated with changes in mean total count of platelet among cement handlers (CH) when compared with non-cement handlers (NCH) as persons control of Dalmia Bharat Cement Plant. In this research the platelet count was found significantly ($P < 0.001$) higher among exposed cement factory workers.

Conclusion: The study's conclusion depending on sensitivity and duration; finds cement dirt exposure has unfavorable effect on platelet count and eventually may have harmful effect on cardiac status among cement handlers (CH) when compared with non-cement handlers (NCH) as persons control of Dalmia Bharat Cement Plant.

Key Word : Cement dirt, Environmental pollution, Hematological system, Platelet count, Factory workers

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I. Introduction

An intolerable number of health problems, have always been caused by environmental pollution important lytoxic cement dirt. Due to persistently high levels of construction development activity, the emerging market has seen an increase in demand for cement manufacturing [1–3]. Pollution from the environment and the workplace is now a direct risk factor for the development of fatal metabolic and systemic diseases [4]. The many stages of cement manufacture, such as clinker cooling, raw material grinding, rotating kilns, packaging facilities, and storage units, produce dirt and other airborne particles [5–6]. Lime, silica, alumina, and iron oxides make up the majority of the basic ingredients required to make cement [7]. Silica exposure can cause acute silicosis; can trigger hematological damaging effect from occupational cement dirt exposures [8]. Exposure to cement dirt has been An alarming environmental pollution issue that may cause injury to organ systems, organs and tissues [9–10]. Cement dirt enters our bodies by eating, inhalation, and epidermal exposures, to a lesser degree. [11]. Cement dirt has deleterious effects on humeral immune system. Increased mortality was found in some studies due to inflammation associated with leukocytosis and thrombocytosis. [12]. Pollution from the environment and the workplace is now a direct risk factor for the development of fatal metabolic and systemic diseases [13]. Hence it is of utmost important to recognize those components of environmental pollutants and causative risk factors or markers of various types of pathogenesis [14]. The current study has explored the persisting consequences of exposure to cement dirt at work on platelet count among cement handlers at Dalmia Bharat Cement Plant at Kalyanpur, Banjari, Bihar state of India. A key

strength of this research is its novel approach in assessing the long-term and detrimental effects of cement dust exposure, an area that has not been sufficiently explored.

II. Material And Methods

The study involved a total of 120 participants from the Dalmia Bharat Cement Plant located in Kalyanpur, Banjari -821303, Bihar, India. Among participants, 60 were workers directly exposed to cement dirt, referred to as cement handlers (CH), due to their job responsibilities over the past eight years. The remaining 60 participants, who had no exposure to cement dirt, served as controls and were classified as non-cement handlers (NCH), consisting of office staff within the same factory. The participants had been employed in the cement industry for an average of 94.15 months (± 3.85 months), which is approximately 7.85 years. Cement handlers were susceptible to cement dirt for about 8 hours each day, weekly 6 days. Blood specimens were collected by paramedical staff at the plant by paramedical staff at the plant. Total of 5 ml of blood was drawn from each participant during fasting state, between 7:00 and 9:00 AM, using the vein-puncture technique. Total of 5 ml of whole blood was drawn from each participant during fasting state, between 7:00 and 9:00 AM, using the vein-puncture technique. These blood samples were transferred to an EDTA vacutainer, mixed well and quickly sent to a hematological laboratory where platelet count was determined based on flow cytometry method by fully automated hematology cell counter (Nihon Kohden MEK- 7300).

Exclusion criteria: Workers with a history of blood transfusions, alcohol use, cigarette and shisha smoking, anemia, asthma, cardiovascular illness, or cancer were not allowed to work. In order to lessen the impact of obesity, workers with a BMI exceeding 30 kg/m² were excluded from the study. Participants in this study were also excluded if they had ever worked in any other business that emits dirt or fumes.

Ethical clearance: The Department of Research and Development's Ethical Committee and Review Board of Chandigarh University in Chandigarh fully authorized the protocol. Researched performed compliance with the ethical criteria that are comparable to the "1964 Declaration of Helsinki" and its later revisions [15]. [ERB/2015/17, Reference No.: DRB-PUC.] In Kalyanpur, Banjari, Bihar, the Dalmia Cement Factory's management authority obtained prior consent. Every participant was informed of the goal of the study. Every participant completed an informed consent form and willingly participated in the study. Researchers assured them of the confidentiality of their personal information, and coding was completed thereafter.

Statistical analysis: Full filled using ANOVA or the Student's paired t-test to compare two groups based on paired data at different significance levels. The data of determinations were expressed using mean $\pm$ S.E. A probability value that was statistically significant ($p < 0.05$) was taken into consideration.

Data collection: This is case-referent study; information was obtained from employees through in-person interviews that were conducted in both their native tongue and English. Employees who met the inclusion criteria were informed about the research objectives, and then they submitted necessary data to full fill survey [16]. Workers participating in tasks such as bagging, loading, grinding, and crushing were exposed to the greatest quantities of cement dirt in their immediate area.

III. Result

The anthropometric index (BMI, Weight & Height) and mean age of the cement dirt exposed cement handlers (CH) assigned as test groups and non-cement handlers (NCH) assigned as control groups were shown in Table no 1.

Tableno1: The socio-demographic profiles of 120 individuals, consisting of Cement Handlers (CH) and Non-Cement Handlers (NCH) at Dalmia Bharat Cement Plant, were examined.

Variables	NCH (n=60) (Range)	CH (n=60) (Range)	P – Value
Age (Year)	34.07 $\pm$ 2.89 (22.0 - 42.0)	38.94 $\pm$ 2.89 (27.0 - 47.0)	> 0.05*
Weight (Kilogram)	59.57 $\pm$ 2.40 (48.0 - 69.0)	62.08 $\pm$ 5.2 (50.0 - 70.0)	< 0.05
Height (Centimeter)	159.70 $\pm$ 5.71 (142.0 - 178.0)	164.60 $\pm$ 4.97 (146.0 - 169.0)	< 0.05*
BMI (meter/Kilogram ²)	24.05 $\pm$ 1.99 (20.5 - 24.5)	22.55 $\pm$ 2.05 (18.5 - 24.5)	< 0.05*
Ratio of Waist to Hip (centimeter)	79.8 $\pm$ 3.05 (<94.0)	90.2 $\pm$ 3.60	< 0.05*

Note: * Significant at $p < 0.05$; ** Significant at $p < 0.01$; values are given as Mean $\pm$ S.E. **Abbreviation:** BMI =Body Mass Index

An analysis of anthropometric measurements performed. Significant differences ($P < 0.05$) were seen in BMI and waist-to-hip ratio (WHR) between cement handlers and non-cement handlers. Most of the research among workers of cement factory focused on impact of cement dirt on their respiratory system. However it is well thought that cement dirt may affect other organs too. In order to assess long term consequences of cement dirt exposure among factory workers; the mean total count of platelet were estimated in blood samples from cement handlers and non-cement handlers. The levels of platelet count were significantly higher ($P < 0.001$) in cement dust exposed workers when compared with corresponding levels in controls. The data is seen as in Table no. 2.

Table no. 2: Impact of exposure of cement dust on test on Platelet count among non-cement handlers (NCH) and cement dust exposed CH with varying times spent in contact with cement dust at Dalmia Bharat Cement Plant.

Parameter		NCH(Range) (n=60)	CH(Range) (n=60)	P - Value
Platelet Count ($\times 10^3/\mu\text{L}$)		234.22 $\pm$ 61.76 (150.0 - 450.0)	297.30 $\pm$ 92.65***	< 0.001

Note: With significance set at p less than 0.05, the results are shown as Mean $\pm$ S.E. *; ** indicates significance at p less than 0.01; and *** indicates significance at p less than 0.001.

IV. Discussion

As best to knowledge, this solitary conducted in Bihar, state in India, that investigates pollution of air and environmental health maladies among Dalmia Bharat Cement Plant workers, focusing on linking prolonged workplace exposure dirt susceptibility with hematological function marker as of few available studies were carried out in Indian states excluding Bihar. The period of dust exposure (about 8 years) was positively correlated with the change in platelet count. The thrombocytosis observed could probably due to the toxic cement dirt that has rousing effects on the bone marrow, leading to increased platelet production or due to the observed anemic manifestation of cement handlers. [17]. The significant higher mean total count of platelet suggests exposure of these workers to cement dirt, which if persistent may perturb this function of cytokines, lipid mediators, and vasoactive amines [18]. The recruited cells release nitrogen and reactive oxygen species, which damages tissue if left unchecked [19]. In response to the harmful components of cement dust, alveolar macrophages, neutrophils, and epithelial cells release inflammatory mediators and cytokines, such as interleukins (IL-1, IL-8) and tumor necrosis factor-alpha (TNF-alpha). These transcription factors cause an acceleration of the inflammatory response [20]. Alveolar macrophages that come into contact with cement dust release TNF-alpha, which triggers the transcription factor GATA-2. Megakaryopoiesis is stimulated by GATA-2 over expression. The platelet count may therefore increase [21]. Review of literatures suggested cement when inhaled; its dirt particles can enter blood circulation [22]. Ours results align to previous studies [23] that prolonged and recurrent exposures, based on the length of time, degree of exposure, and personal sensitivity hazardous cement dirt causes increased platelet count among workers in the cement industry internationally.

V. Conclusion

The current research endeavor sought to examine the prolonged, uncontrolled and repeated exposure of cement dirt on hematological markers specifically mean total counts of platelet among Dalmia Bharat Cement Plant workers. Persistent toxic cement dirt exposures revealed significant elevation of platelet count thus documenting haematological danger of cement dirt exposure among cement handlers compared with control group. The present research concludes relative thrombocytosis among cement handlers. Hematological parameters are said to be the sensitive index that could be useful as an indirect predictive or distinctive tool in assessing the toxicity of cement dirt. The health-related complications might exacerbate if the exposure to cement dirt among cement handlers is not controlled.

Conflict of interests

There are no conflicts of interest pertaining to the publishing of this research, according to the authors.

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