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Study Of Repeated Susceptibility To Cement Dirt Exposure And Its Persistent Consequences On Liver Function Markers Among Male Cement Handlers At Dalmia Bharat Cement Plant

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Abstract
Background: *This study focused cement male handlers at Dalmia Bharat Cement Plant had long-term impacts of cement dirt exposure on selected liver function markers. Repeated and protracted exposures, depending on sensitivity and duration, have led to detrimental health conditions and deteriorating health, especially liver malfunction due to toxic cement dirt.*
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 average age of the workers were 36 years (±1.51 years), and their mean (BMI) body mass index were 21.60 (±2.56 kg/m²). 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 after clotting 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. These blood samples were transferred to vacationers and quickly sent to a clinical laboratory for analysis, where hepatic biomarkers were assessed. Liver enzymes namely AST, ALT, GGT and ALP in serum along with plasma TP and Alb. was determined.*
Results: *Results of current study unveiled risk for hepatocytotoxicity (liver cell damage) had been significantly associated with elevated serum key levels of marker enzymes of liver function, namely, Aspartate amino transferase (AST), Alanine amino transferase (ALT), Gamma-glutamyl transferase (GGT), Alkaline phosphatase (ALP) whereas decreased level of plasma total proteins (TP) and albumin (Alb.). Thus, the present study finds positive association of cement dirt exposures with hepatic nemesis among cement handlers (CH) when compared with Non-cement handlers (NCH) as persons control of Dalmia Bharat Cement Plant.*
Conclusion: *The study's conclusion showed that uncontrolled, persistent dirt exposure caused about considerable hepatic cellular damage statically.*
Key Word: *Cement dirt, Environmental pollution, Liver function markers, Cement handlers.*

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I. Introduction

An intolerable number of health problems, have always been caused by environmental pollution importantly toxic cement dirt. According to this perspective, the cement sector is important and is growing quickly both globally and in India. Due to persistently high levels of construction development activity, the emerging market has seen an increase in demand for cement manufacturing [1–3]. The cement industry contributes to pollution in the environment [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 trigger hepatic silicosis and other detrimental effects on many bodily organs from occupational exposures [8]. Exposure to cement dirt has been a growing issue and is the cause of disturbed liver function including total proteins and albumin levels, potentially leads to liver damage, can trigger inflammation responses, potential hepatic damage and impairment in hepatic function. [9–10]. Additionally, toxic cement dirt susceptibility is linked to hepatocytotoxic consequences [11]. A damage liver usually attracts infiltration of mononuclear inflammatory cells and Kupffer's cells laden with bile pigment. The

cellular leakage and loss of functional integrity of the cell membrane damaging the residual β cell mass to further loss [12]. A key strength of this research is its novel approach in assessing the long-term and detrimental effects of cement dirt 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 average age of the workers were 36 years (±1.51 years), and their mean (BMI) body mass index were 21.60 (±2.56 kg/m²). 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 after clotting 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. These blood samples were transferred to vacationers and quickly sent to a clinical laboratory for analysis, where hepatic biomarkers were assessed. Liver enzymes namely AST, ALT, GGT and ALP in serum along with plasma TP and Alb. was determined. Statistical analysis done using full filled 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 ± S.E.

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 [12]. [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 ± 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 [13]. 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. Results

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.

Table no 1: 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 ± 2.89	38.94 ± 2.89	> 0.05*
	(22.0 - 42.0)	(27.0 – 47.0)	
Weight (Kilogram)	59.57 ± 2.40	62.08 ± 5.2	< 0.05
	(48.0 – 69.0)	(50.0 – 70.0)	
Height (Centimeter)	159.70 ± 5.71	164.60 ± 4.97	< 0.05*
	(142.0 – 178.0)	(146.0 – 169.0)	
BMI (meter/Kilogram^2)	24.05 ± 1.99	22.55 ± 2.05	< 0.05*
	(20.5 – 24.5)	(18.5 – 24.5)	
Ratio of Waist to Hip	79.8 ± 3.05	90.2 ± 3.60	< 0.05*

(centimeter)	(< 94.0)		

Note: * Significant at p < 0.05; ** Significant at p < 0.01; values are given as Mean ± 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. In order to assess long term response to cement dirt on liver function markers among exposed factory workers, blood samples from cement handlers and non-cement handlers were collected. Results demonstrated substantially mere significantly higher (P<0.05) serum key levels of marker enzymes of liver function, ALT, AST ALP and GGT whereas the reduction in plasma total proteins and albumin is found in cement dirt exposed worker when compared with corresponding levels in controls. The data is seen as in Table no 2.

Table no 2: Impact of exposure of cement dirt on test on liver function markers among non-cement handlers (NCH) and cement dust exposed CH with different durations of exposure to cement dust at Dalmia Bharat Cement Plant.

Parameters		**NCH (Range) (n=60)**		**CH (Range) (n=60)**		**P - Value**
AST		21.11 ± 3.21 (10 - 40)		44.20 ± 5.48*		< 0.05
ALT		23.91 ± 4.18 (10 – 40)		46.14 ± 7.02*		< 0.05
GGT		14.77 ± 7.73 (10 – 30)		39.07 ± 8.37**		< 0.05
ALP		75.84 ± 5.14 (53 – 128)		99.12 ± 9.06*		< 0.05
TP		7.86 ± 0.61 (6 – 8)		6.10 ± 1.12*		< 0.05
AIb		4.93 ± 0.09 (3.3 – 4.8)		3.51 ± .014*		< 0.05

Note: The information is shown as Mean ± S.E. *, with significance set at p < 0.05; **, significant at p < 0.01; ***, significant at p < 0.001.

Abbreviation: Alpha-glutamyl transferase (GGT), aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphates (ALP), total proteins (TP), and albumins (Alb).

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 dust susceptibility with occurrence of hepatocellular disorders as the few available studies were carried out in Indian states excluding Bihar. Health hazards of cement dirt pollution include an array of health -related complications negatively impacting people's health in a number of ways like hepatocellular disorders, stomachache, ailments of the respiratory system, and other critical organs such the liver, spleen, pancreas, heart and kidneys as a result of recurrent exposure to heavy metal-containing dust crystalline silica-

alumina [14] Cement dirt contains heavy metals like cadmium and lead, their bioaccumulation in the liver and cause toxic effects. Cement dirt, to which if persistently exposed may resulted in inflamed liver that can lead to an increased risk of hepatocellular damage [15]. It is of interest to note that the present study exhibits a significant elevation ($P<0.05$) of AST, ALT and ALP levels in cement handlers compared with the control group. The elevation of serum GGT concentration is regarded as one of the most sensitive indices of hepatic damage [16]. An increase in the serum levels of marker enzymes, in turn, reflects the onset of hepatocellular necrosis or increased membrane permeability caused by cement dirt toxicity. Acute stages of a variety of disorders linked to inflammation and tissue damage are marked by cement dirt exposure. Toxic chemicals included in cement dust can cause inflammatory changes in organs such as the skin, liver, lungs and heart. [17]. Cement dirt causes diffuse swelling and proliferation of sinusoidal (hepatic) lining cells, perisinusoidal and portal fibrosis in the liver of cement mill workers. [18].The observed reduced mean of plasma total proteins and albumin ($P<0.01$) in cement workers might potentially be attributed to impaired liver function. Hence it is of utmost important to recognize those components of environmental pollutants and causative risk factors or markers of various types of pathogenesis. Ours results align to previous study [19] that prolonged and recurrent exposures, based on the length of time, degree of exposure, and personal sensitivity cause significant impairment of liver function in 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 liver function markers among Dalmia Bharat cement plant male workers. Our results revealed considerable changes in serum levels of key hepatic enzymes along with plasma total proteins and albumins levels that indicate liver dysfunction in cement handlers in contrast to their equivalent non-cement handlers. The repeated susceptibility to cement dirt had persistent deleterious consequences on hepatic function closely related to inhaled cement dirt particles. Thus liver function markers may be useful in assessing and monitoring the health of cement factory workers in addition to the traditional lung function markers. 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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