



The Effects of Inhaling Cement Particles on Some Coagulation Parameters of Bricklayers and Blockmakers in Owo Ondo State Nigeria

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ABSTRACT

Background: Economic development alters the natural environment and sometimes harms ecosystems in terms of the humanly useful services they provide, their diversity, and their resilience. We are coming to understand that all of this has significant consequences for human health. Environmental health has been understood as a public health issue in relation to air quality, water quality, and exposure to environmental pollutants that are toxic, carcinogenic, or teratogenic or are chemically bioactive in other ways.

Aim: This study investigates the effect of inhaling cement particles on some coagulation profiles among the brick layers and block makers in Owo, Ondo State.

Method: This was cross-sectional descriptive and analysis of 50 brick layers and block makers together with 50 non brick layers nor block makers that serve as controls.

Results: The results from the study shows a statistically significant increase in platelet count ($p < 0.05$) when compared to the control, while a statistically significant reduced time of PT and APTT were recorded ($p < 0.05$). There were no statistically significant results when the years of exposure were considered as shown in table 2 ($p > 0.05$)

Conclusion: The results of this work shows that exposure to cement particles exposes the workers to hypercoagulability which is a tendency to thrombosis, thromboembolism and can also leads to cardiovascular disease.

INTRODUCTION

Cement making is inevitably a dusty operation as it is much concerned with hot dry powders and it is one of the largest manufacturing industries and its workers are exposed to dust at various manufacturing and production process¹

Most of the world's population spent one third of their life at work contributing actively to the development and wellbeing of themselves, their family and the society. The right to health and safety at work is therefore a part of basic human right². Environmental and occupational pollution has always been a major cause of morbidity and mortality. The incidence of the occupational disease is constantly increasing throughout the world, especially in developing country due to lack of proper quality control documentation and partial approach towards this mammoth problem.³ Studies carried out in Nigeria among cement industry workers revealed an inventory of hazards such as respiratory problems, irritation and contact dermatitis, organ-system perturbations particularly of the lungs and liver, physical injuries like burns, headache, fatigue and musculoskeletal disorders^{4,5}

Cement is one of the most essential building materials in the world, and some of its constituents include calcium oxide, silicon oxide, aluminum trioxide, ferric oxide magnesium oxide, sand and other impurities⁶. The smoke and dust produced by some industries cause various types of pathogenesis. The unhygienic exposure of the smoke and dust are linked with an increased risk of chronic obstructive pulmonary diseases⁷. In this vita, cement workers may also be exposed to numerous types of occupational hazards, and these materials are the major culprits in mortality and morbidity. The cement dust or its constituents causes pathogenesis of various lung diseases including chronic bronchitis, asthma, lung cancer, pneumonia and tuberculosis³

A study among cement workers in Nigeria revealed that there were no specific training programs for safety education, protective measures or accident prevention for workers. On the part of the workers, study showed that the workers were reluctant to wear the proper protective uniforms for their job. Various studies have also shown that workers are unaware of the occupational hazards to which they are exposed^{8,9}

METHODS

Study Design and sampling

This cross-sectional study was conducted among the brick layers and block makers in Owo Ondo State. Owo is situated in South-West Nigeria, at the Southern edge of the Yoruba Hills, and at the intersection of roads from Akure, Kabba, Benin City and Siluko

Blood Samples Collection

About 10ml of blood samples were collected from the ante-cubital fossa after disinfected with 70% alcohol from each subject. 4.5ml of the blood were dispensed into citrate bottle containing 0.5ml of 3.2 tri-sodium citrate solution in a ratio of blood to citrate, 9:1 (v/v). 5ml of the samples were dispensed into the EDTA bottle. The blood was thoroughly mixed by inverting the container several times gently. The citrate blood was spun immediately in a bench centrifuge at 5000rpm to obtain platelet poor plasma (PPP) for PT and PTTK while the EDTA sample was used for the platelet count. The citrate samples were kept in the freezer for further analysis.

Prothrombin Time Assay

Principle:

The presence of calcium, tissue thromboplastin initiates the extrinsic coagulation pathway by the direct activation of factor VII to VIIa. This culminates in the conversion of soluble fibrinogen to insoluble fibrin by the direct action of thrombin. Reduction in the concentration of clotting factors of the extrinsic or common pathways will result in the prolongation of the prothrombin time (PT), the degree of which is proportional to the level of concentration reduction.

Procedure:

Into a clean glass tube, 100ul of brain thromboplastin was added, it was incubated for 2minutes at 37°C, 100ul of plasma was dispensed into it, 100ul of prewarmed calcium chloride was also added and stop watch was started. The Tube was gently tilted at 2 seconds intervals (returning to the water bath between titling) and the time for the formation of a clot was recorded in seconds. Control test was equally run along with the plasma for each batch of test. The test was carried out in duplicate for both subject's sample and a normal control, and the mean value was obtained.

Activated Partial thromboplastin Time Assay

Principle of the test:

Kaolin (surface activator) and platelet substitute (phospholipid) activates the coagulation factors of intrinsic pathway of blood coagulation mechanism in the presence of calcium ion when incubated with citrated plasma at 37°C and the time taken for the mixture to clot is measured in seconds. APTT is prolonged by a deficiency of one or more of these clotting factors of intrinsic pathway and in the presence of coagulation inhibitors like heparin

Procedure

A clean glass tube was placed in a water bath kept at 37°C. 200ul of kaolin/platelet substitute was dispensed into it and 100ul of plasma was added. After one minute, 100ul of pre-warmed 0.025M calcium chloride (CaCl₂) was dispensed and Stopwatch was started immediately. The contents were gently mixed. The stopwatch was stopped immediately at the sight of a fibrin clot and time was recorded. Control test was equally run along with the test plasma for each batch of the test.

Platelet count

Principle

Blood is diluted 1 in 20 in a filtered solution of ammonium oxalate reagent which lysis the red cells. Platelets counted microscopically using an improved Neubauer counting chamber and the number of platelets per liter of blood calculated (Cheesbrough, 2010).

Procedure:

Into clean tube 20 µL of blood was dispensed into 0.38ml of 1% ammonium oxalate and left for 15 minutes for complete lysis of RBCs. Mounted the Neubauer chamber and left the chamber for 15 minutes in the high humidity. Then counted the large central square.

RESULTS

We set out to determine the effect of exposure to cement particles on platelet count and some coagulation profiles among bricklayers and blocks molders in Owo township. The results of the tests in table 1: showed a statistically significant increase in platelet count ($p < 0.05$) when compared to the control, while a statistically significant reduced time of PT and APTT were recorded ($p < 0.05$).

There is no statistically significant results when the years of exposure were considered as shown in table 2 ($p > 0.05$).

Table 1: Comparison of plate some coagulation profiles between the subject and the controls

| Parameters | Subjects (n=50) | Control(n=50) | t-value | p-value |
|------------|--------------------|--------------------|---------|---------|
| PLT | 452220.00±54683.99 | 233026.00±77672.61 | 16.32 | <0.0001 |
| PT | 8.32±1.46 | 12.78±2.48 | -10.97 | <0.0001 |
| APTT | 26.23±2.62 | 37.53±9.94 | -7.77 | <0.0001 |

PLT=Platelet

PT=Prothrombin Time

APTT=Activated Partial Thromboplastin Time.

Table 2: Duration of exposure to cement particles and coagulation profiles

| Parameters | 1-3 Years | Above 3 years | t-value | p-value |
|------------|---------------------|--------------------|---------|---------|
| PLT | 397000.00±454520.83 | 233026.00±77672.61 | 1.46 | >0.05 |
| PT | 9.59±1.55 | 8.27±1.45 | 1.26 | >0.05 |
| PTTK | 26.82±2.62 | 26.21±2.67 | 0.32 | >0.05 |

PLT=Platelet

PT=Prothrombin Time

APTT=Activated Partial Thromboplastin Time.

DISCUSSION

The major pollution problem in cement factories is cement dust¹⁰. Exposure to this dust may lead to damaging effects to biological systems, tissues and organ. Harmful effects like dermatitis, laryngeal cancer, lung cancer, Gastrointestinal tumor have been reported in cement dust exposed individuals^{11,12}

The result obtained from this investigation show a statistically significant increase in the level of platelet count in the subject when compared with the control. This is in agreement with the previous studies done by^{13,14} where it was reported an increase in platelet level

of workers in cement industry and attributed the increased to excess production of hematopoietic regulatory element such as colony stimulating factors, erythropoietin and thrombopoietin by the stromal cells and macrophages in the bone marrow¹⁴. It has been stated also that Inflammation causes release of factors like Tumor Necrosing Factor alpha that may stimulate increased production of platelets from the bone marrow¹⁵. Platelet count can also be potentially increased when a relatively large amount of body tissue is damaged either by exposure to toxins, following surgery or after an accident. Rose et al¹⁶ stated that infections are the most common cause of a high platelet

count in both adults and children. 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^{14,17,18}

The results of prothrombin time test showed a significant decrease when compared with the control. Prothrombin time test (PT) is a screening test that detects abnormalities in both the extrinsic and the common pathways of blood coagulation. Prolong in the result of this test indicate a deficient of one or more clotting factors that are present in this pathway or presence of anticoagulant. Decrease in the result shows hyper activity in the pathway and the result is similar to the work of Lee-Tsai¹⁹ where it was reported that the shortness of the PT and APTT test are significant as associated with a history of thrombotic event in Mexican population. The result of Activated Partial Thromboplastin (APTT) from this study when compared with the control was statistically significantly lower. APTT is commonly used as part of a general screen for coagulation disorders in patient with abnormal bleeding. The APTT evaluate the intrinsic pathway of coagulation cascade. It is very sensitive to coagulation disorders and deficiencies within the intrinsic pathway as well as heparin sodium therapy. The result of this work correlate with the previous work done by²⁰ where it was concluded that a shortened PT and APTT in dogs may be indicative of hypercoagulability state as evidenced by an increased incidence of thrombosis. Edson et al²¹ suggested that short APTT may be correlated with elevated levels of the factor VIII procoagulant and possibly, a tendency for thrombosis. In the work of Korte et al²² it was reported that the patients with a short APTT, are at significantly increased risk for thromboembolism, mainly venous thromboses. Previous studies have also revealed that shortened APTTs have been associated with high levels of biochemical markers of thrombin generation and fibrin deposition such as prothrombin fragment 1 + 2, thrombin-antithrombin complex, and D-dimer^{22,23} as well as with a poor prognosis for thrombosis and mortality²⁴

Comparison of years of exposure to cement dust particles and the measurement of all these parameters were done, the differences seen in the results were not statistically significant, indicating that year of exposure does not matter once alteration either due to toxins or infection is done and remain in the body.

CONCLUSION

The results of this work shows that exposure to cement particles exposes the workers to hypercoagulability which is a tendency to thrombosis and thromboembolism and can also leads to cardiovascular disease.

Author's Contribution

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Conflict of interest: No conflict of interest to declare.

Ethical Clearance

Ethical clearance for the study was granted by the Ethics Review of Federal Medical Centre, OWO with no FMC/OW/380/VOL.CLV/150.

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