Original research Article

Haematological Alterations in Cement Loaders within Port Harcourt Metropolis

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Abstract

BACKGROUND: Exposure to cement dust without necessary precautions to prevent its inhalation is found to cause respiratory, dermatological, ocular as well as hematological problems and this is a matter of great concern to the health of cement loaders.

AIM OF STUDY: This study is aimed at determining haematological alterations in cement loaders in Port Harcourt Metropolis.

STUDY DESIGN: Case control study design

METHODOLOGY: A total 100 apparently healthy subject consisting of 50 loaders and 50 non loaders aged between the ages of 20- 45years old were recruited for the study. Four millilitres (4mls) of venous blood was collected from the antecubital vein of each participant using standard venepuncture technique into ethylene diamine tetra acetic acid (EDTA) anticoagulated vacutainer bottles with proper mixing to avoid blood clotting and then analysed using Sysmex haematology autoanalyser. Graphpad prism version 6.2 was used to analyse the data obtained.

RESULTS: Results obtained showed a statistically higher value ($p<0.05$) in platelet count ($p=0.0001$), lower values ($p<0.05$) in haemoglobin concentration (Hb), Packed cell volume (PCV), Mean cell volume (MCV) and Mean cell haemoglobin (MCH) ($p=0.0001$). No significant difference ($p>0.05$) was observed in the values of red blood cell (RBC) count ($p=0.3110$), white blood cell (WBC) count ($p=0.8138$) and mean cell haemoglobin concentration (MCHC) ($p=0.0584$) respectively.

CONCLUSION/RECOMMENDATION: This study has confirmed that there are haematological alterations in cement loaders in Port Harcourt metropolis and these alterations are attributed to inhalation of cement dust during work. It is recommended that cement loaders be on a mandatory use of appropriate personal protective equipment during work hours and around area where cement dust are generated.

Keywords: *Haematological, Cement Loaders, Dust, platelets, Port Harcourt.*

Introduction

The Port Harcourt of today is markedly characterized with construction of buildings, flyover bridges, roads and other amenities and this constitute major activities in urbanization. The government of the day is bent on industrialization and urbanization of the city and as such there has been an increase in the activities of cement loader within the city. Cement loaders are

exposed to cement dust during the grinding of the clinker, blending and packaging, shipping and offloading of the finished cement products to distributors or buyers (Meo,2004; Emmanuel et al., 2015).

Several health hazard associated with cement dust have been reported in literature. High concentration and/or prolonged inhalation of cement dust in cement loader on site during bagging, standing, shipping and offloading are capable of provoking clinical symptoms and inflammatory response that may result in functional and structural abnormalities with the most frequently reported clinical features in cement loaders being chronic cough and phlegm production, impairment of lung function, chest tightness, obstructive and restrictive lung disease, skin irritation, conjunctivitis, stomach ache, headache, fatigue (Abou, 2005) together with possible cancer of the lungs, stomach, colon, silicosis and haematological derangement (Osaro et al.,2013; Jagadishnaik, 2012; Jude *et al*.,2002; John and Olubayo , 2011, Kakooei et al.,2012). Neboh *et al*., 2015 also found that exposure to cement also causes a significant reduction in life expectancy of the average population of workers within Enugu metropolis by a month or more.

Cement is a product made from limestone, laterites, clay and gypsum; and its composition includes, lime (calcium oxide), aluminium trioxide, silica (silicon dioxide), iron oxide, chromium and other impurities (Farheen et al., 2017; Fell et al., 2010). Some components of cement dust have been found to be hazardous to human health; component such as lime (calcium oxide) an alkaline substance is found to be corrosive to human tissue, crystalline silica also is associated with damages to the lungs and highly abrasive to the skin while the chromium component of cement dust is capable of eliciting allergic reactions (Meo, 2004; Syed *et al*., 2013, Emmanuel et al., 2015). Cement dust emission are seen to originate solely from the raw milk, the kiln system, clinker coolers, cement mill (Syamala *et al*, 2017) and of course during loading and offloading (packaging and commercial storage sessions). The type of particulate generated is linked to the

source of emission itself either partly calcined (raw material or clinker or cement (Karstensen., 2007) with main route of entrance of cement dust into the body being through the respiratory tract by inhalation or gastrointestinal tract by swallowing or both (Manjula *et al*., 2013).

The haemopoietic system of humans is control by series of factors that moderate the quantitative and qualitative abnormalities found in the peripheral blood. This is due solely to imbalances between the rates of cell production, the rate at which they are release into circulation and their survival or loss from the system. Haematological parameters such as haemoglobin concentration (Hb), packed cell volume (PCV), red blood cell (RBC) count, white blood cell (WBC) count, platelets count together with red cell indices (Mean cell volume (MCV), mean cell haemoglogin (MCH), mean cell haemoglobin concentration (MCHC) etc constitute measurable index of the haematopoietic (blood) system use to access the normality, functionality of the blood of an individual in other to diagnose vis a vis establish a state of health or disorder.

The findings of recent studies conducted by Farheen *et al*., 2017, Ashwini et al (2016), Okonkwo et al (2015), Jude *et al*., 2002 and Mojiminiyi *et al*., 2008 suggests that cement dust causes hematological and cytogenic damage among cement workers. Paucity of information on the effects of cement dust on haematological parameters of cement loaders in Port Harcourt Metropolis triggered our quest to synthesize knowledge in this area and as such this study focuses on determining any possible alteration in haematological parameters in cement loaders within Port Harcourt Metropolis.

Material and Methods

Study Area

Port Harcourt is the metropolitan city in Rivers State. With respect to geographical location, it lies at latitude $4{,}75^0$N and longitude 7.00^0E across Bonny River in Niger Delta. During the 2007 census, the population of Rivers State stood at about 1,620,214 (2007). The city is marked with

unregulated building plans which have triggered unnecessary flooding whenever it rains. Port Harcourt is a tropical zone with lengthy and intense rainy seasons and short dry season. The heaviest rain pours during the month of September where approximately 370mm of rains fall, while December on the average is the driest month of the year with only 20mm of rains. The temperature of the city ranges 25^0C – 28^0C in the year.

Study settings

A case control study involving one hundred (100) apparently healthy male volunteers (with 50 non-cement loaders as control and 50 cement loaders as subject) aged within the ages of 20-45years were recruited with the use of questionnaires. Subjects with history of smoking, hypertension, diabetes mellitus and other chronic diseases were excluded from the study.

Study protocol

Data were collected on general demographic profile, smoking, alcohol consumption, medical/clinical history, history of past diseases and clinical signs. Four millilitres (4mls) of venous blood was collected from the antecubital vein of each participant using standard venepuncture technique into ethylene diamine tetra acetic acid (EDTA) anticoagulated vacutainer bottles with proper mixing to avoid blood clotting. These samples were transported to the Braithwaite Memorial specialist Hospital, Haematology laboratory within half hour and analysed using automated machine (Sysmex haematology autoanalyser) for various hematological parameters such as hemoglobin concentration (Hb), red blood cell count (RBC), white blood cell count (WBC), platelets (PLT), packed cell volume (PCV), Red cell indices such as mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC).

Statistical analysis

Data obtained were analysed using Graphpad prism software package version 6.2 and results expressed with Box and whisker plot. $p<0.05$ was considered significant.

RESULTS

Results obtained showed a statistically higher value ($p<0.05$) for platelet count ($p=0.0001$), lower values ($p<0.05$) of haemoglobin concentration (Hb), Packed cell volume (PCV), Mean cell volume (MCV) and Mean cell haemoglobin (MCH) ($p=0.0001$). No significant difference ($p>0.05$) was observed in the values of red blood cell (RBC) count ($p=0.3110$), white blood cell

(WBC) count (p=0.8138) and mean cell haemoglobin concentration (MCHC) (p=0.0584) respectively when cement loaders was compared to non-loaders (controls) as shown in Box and Whiskers plot in figure 1-8.

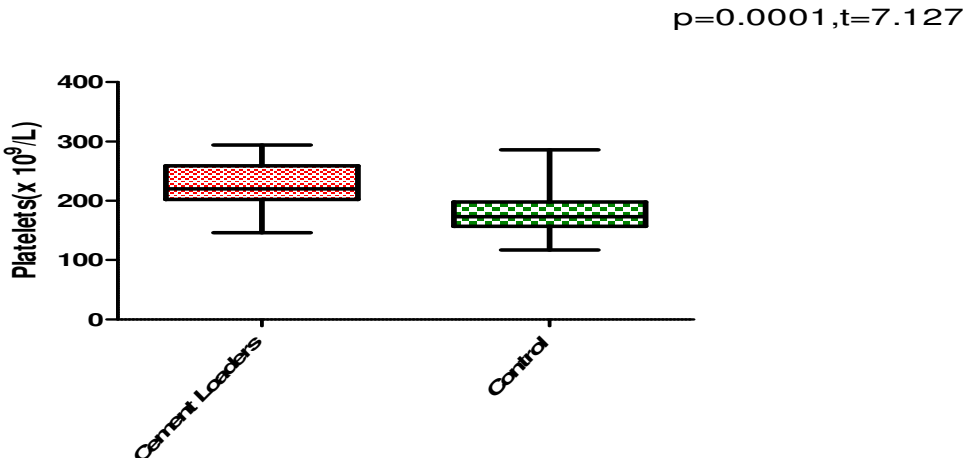

Figure 1: Box and whiskers plots of platelets count levels of cement loaders and control

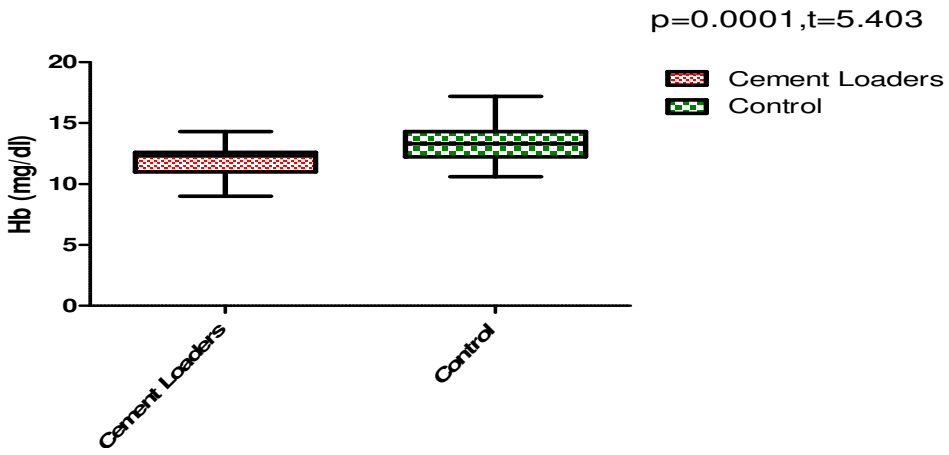

Figure 2: Box and whiskers plots of haemoglobin concentration (Hb) levels of cement loaders and control

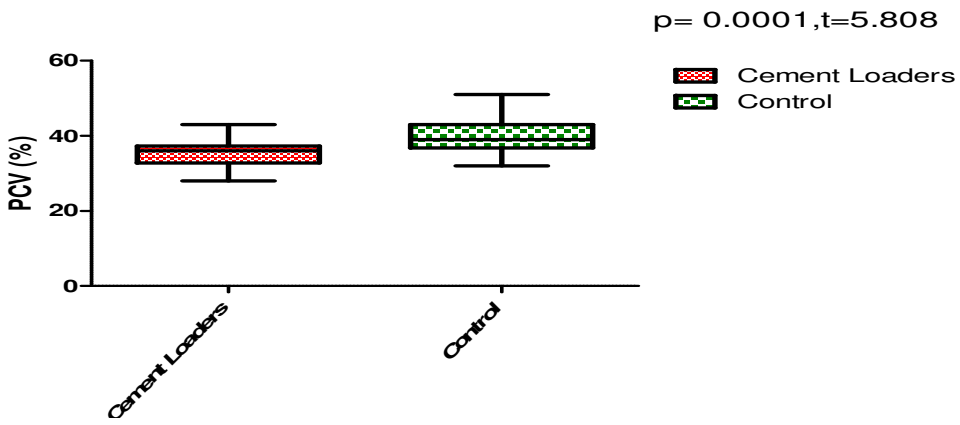

Figure 3: Box and whiskers plots of packed cell volume (PCV) levels of cement loaders and control

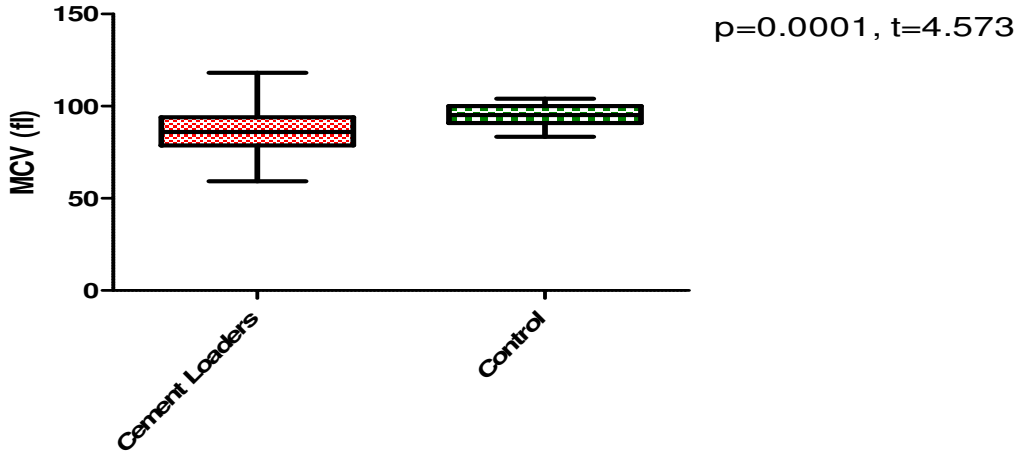

Figure 4: Box and whiskers plots of mean cell volume (MCV) levels of cement loaders and control

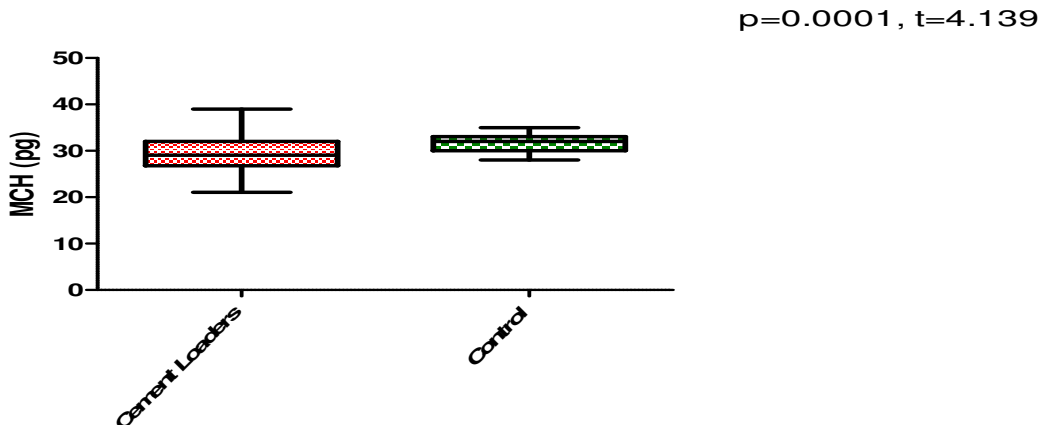

Figure 5: Box and whiskers plots of mean cell haemoglobin (MCH) levels of cement loaders and control

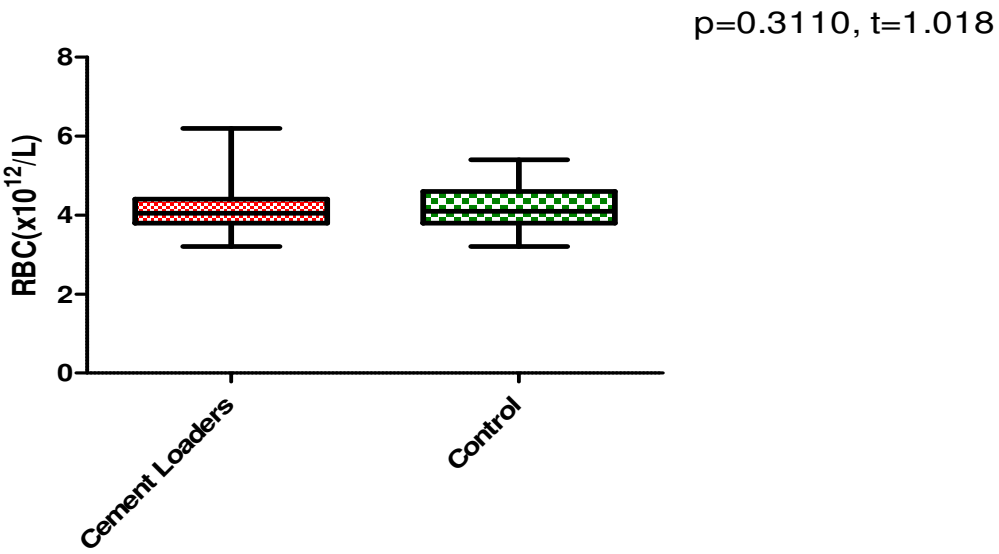

Figure 6: Box and whiskers plots of red blood cell (RBC) levels of cement loaders and control

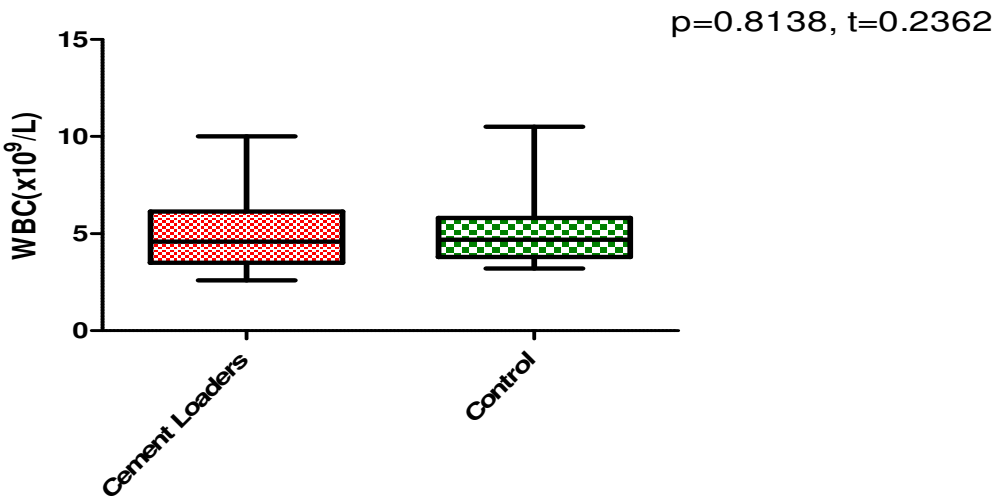

Figure 7: Box and whiskers plots of white blood cell (WBC) count levels of cement loaders and control

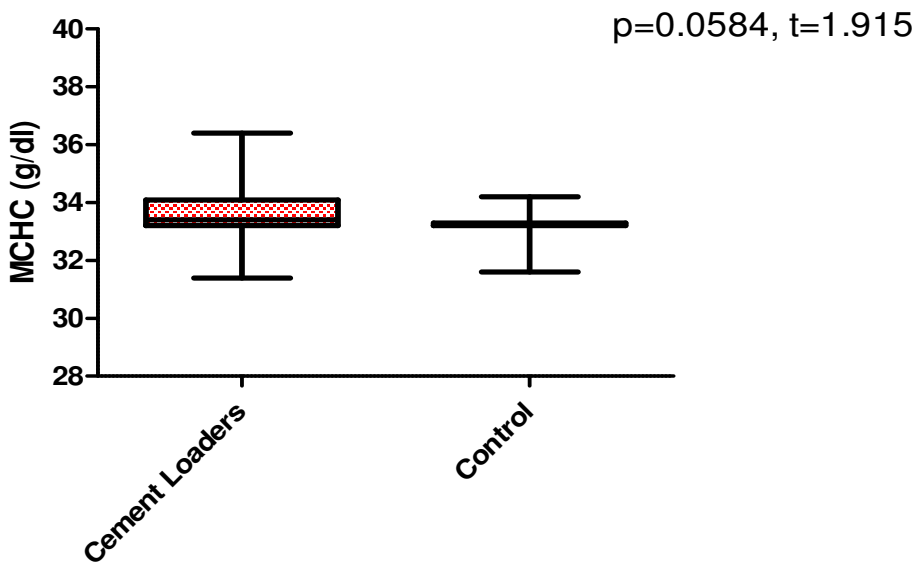

Figure 8: Box and whiskers plots of Mean cell haemoglobin concentration (MCHC) levels of cement loaders and control

DISCUSSION

This study was carried out to determine if there are alterations in haematological parameters in cement loaders in Port Harcourt as a result of exposure to cement dust. Findings in this study shows a statistically higher value in platelet count when the values of cement loaders were compared with non-loaders. This findings is in tandem with the results of Ashwini et al, (2016), Emmanuel et al, (2015), Mojiminiyi et al, (2008) who reported increase in platelets but not in conformity with the findings of Farheen et al, (2017), Okonkwo et al (2015) and Jude et al., (2002) who found significant decrease in the platelet count of construction workers exposed to cement dust after work shift. The increase in platelet count in this research could be attributed to certain component of cement that has the capacity to stimulate the bone marrow in further production of platelets cells or has possible effects on the iron storage condition of the haemopoietic stem cell and this further could explain the decrease in haemoglobin concentration as well as packed cell volume. Mojiminiyi et al *(*2008) attributed the rise in platelet cells count to be a response to toxic effect of cement dust inhaled into the lungs. However, increase in stress response due to cement dust can trigger increase platelet production in the haemopoietic cells with resultant rise in platelet count on analysis; this can lead to RBC swelling or haemoconcentration plasma volume reduction. The increase platelet count can also be attributed

to the underlining haemolytic condition noticed with the red blood cells in this study. Haemolytic anaenia and some malignancies are triggers to increase platelet count.

The haemoglobin concentration (Hb), packed cell volume (PCV), Mean cell volume (MCV) and Mean cell haemoglobin (MCH) values were significantly lower in this study and this is in agreement with the finding of Farheen et al, (2017), Ashwini et al (2016), Mojiminiyi et al (2008). This further confirms that cement dust has toxicological as well as deleterious effects on the haemopoietic system.

The bioaccumulation of cement dust has been found to affect the bones in animal studies causing osteonecrosis, thinning of cortex, reduction in epiphyseal cartilage over time (Manjula et al., 2013, Pond et al., 1982), If this assertion is true, then the bone of human too is likely to suffer same fate and can result in ineffective storage of iron absorbed from diets in the small intestine.

The chromium component of cement dust is capable of eliciting allergic reactions (Meo, 2004; Syed *et al*., 2013, Emmanuel et al., 2015) and this can result in self destruction of red cells (haemolysis) in circulation and account for the possible lower levels of Hb, PCV etc found in this study. Also, Chromium together with other metals such as nickel, lead and copper is listed amongst metal substances that can cause haemolytic anaemia and as such inhalation of cement dust can accommodate large quantities of this chromium with resultant allergic as well as haemolytic reactions. This could be a further explanation to the above decrease in haemoglobin and packed cell volume observed in this study, although the total red cell count was not significantly affected.

There was no significant difference in the values of White blood cell (WBC) count, red blood cell (RBC) count and MCHC when loaders values were compared to that of non-loader who served as controls and this differ from the findings of Emmanuel et al, (2015), Mojiminiyi et al (2008) who recorded significant differences in WBC, RBC and MCHC.

CONCLUSION

This study has confirmed that there are haematological alterations ranging from increase in platelets count; decrease in haemoglogin concentration (Hb), packed cell volume (PCV), MCV, MCH in cement loaders in Port Harcourt metropolis and these alterations are attributed to inhalation of cement dust during work.

RECOMMENDATION

We recommend a further analysis that examines the histology and blood picture of cement loaders in Port Harcourt. Also, it is recommended that cement loaders should be on a mandatory use of appropriate personal protective equipment during working hours and around area where cement dust are generated.

LIMITATION OF THE STUDY

This study did not include blood picture analysis. A blood picture of the red cell together with the red cell indices values would have been helpful in classifying the type of anaemia present in cement loaders in Port Harcourt.

CONSENT

Informed consent was obtained from each participant

ETHICALAPPROVAL

Approval to conduct the research was granted by the Department of Medical Laboratory Science, Rivers State University, Nigeria.

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