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CEMENT DUST EXPOSURE AFFECTS HAEMATOLOGICAL PARAMETERS IN CEMENT LOADERS IN ENUGU METROPOLIS, SOUTH-EAST NIGERIA.

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ABSTRACT

Cement loading has remained a major source of income for low-income, able-bodied men, although many ailments have been linked to cement dust exposure. To investigate the effects of cement dust on haematological parameters of cement loaders in Enugu Metropolis. Sixty (60) adult males, aged 25-40 years, comprising of 30 cement loaders who have loaded cement for at least 3 years and 30 apparently-healthy, age-matched non-cement loaders (controls) participated in this study. Three (3.0) ml of venous blood samples were collected from each participant into Tri-potassium Ethylene-diamine tetra acetic acid (K_3EDTA) anticoagulant containers for haematological analysis using standard operative procedure. SPSS version 15.0 was used for the statistical analysis and the test of significance was calculated using student's *t*-test. The results revealed significantly decreased haemoglobin, haematocrit and neutrophil, and significantly ($p<0.05$) increased lymphocyte and platelet when compared with the controls ($p<0.05$). This result pattern demonstrates that cement dust does not only affect respiratory system but could also alter some haematological parameters and white blood cell (WBC) differentials of cement loaders. Haematological assessment may be included in periodic monitoring of the health status of industrial workers exposed to cement dust.

Key words: Cement loaders, Dust, Haematological parameters, WBC differentials.

INTRODUCTION

Cement, fine, grey or white powder largely made up of Cement Klin Dust (CKD) is a by-product of the final cement product usually stored as waste in open pits and unlined landfills (Hassen et al., 1998). Cement dusts are basically made of calcium oxide, silicon oxide, aluminum oxide with little quantity of iron oxide, magnesium oxide, chromium, potassium, sodium and sulphur (Fell et al., 3003) (Gbadebo and Bankole, 2007).

Studies have shown that cement dust may enter into the systemic circulation, thereby reaching all the organs of the body and affecting the different tissues including heart, liver, spleen, bone, muscle and hairs and ultimately affecting their micro structure and physiological performance (Stern et al., 2001). However, chronic exposure to aluminum one of the major constituent of cement could increase lipid peroxidation in different tissues resulting in neurotoxicity, renal failure and anaemia (Mohammadirad and Abdollahi, 2011).

Cement dust exposure causes lungs function impairment, chronic obstructive lungs disease, restrictive lung disease, laryngeal and lung cancer (Stern et al., 2001) (Meo et al., 2002). The development and severity of injury caused by the cement dust on plants and animals depend not only on the concentration of the pollutant, but also on the length of exposure to the pollutant, the species and stage of development as well as the environmental factors, hence making the organism either susceptible or resistant to injury (Heather and Lechtman, 2003).

Acute effect such as eye, nose and upper respiratory track irritation, cough, shortness of breath and wheezing have been recorded in humans due to exposure to cement dust (Laraqui et al., 2001). The human haematopoietic system is extremely sensitive to environmental d men in

influences due to rapid synthesis and destruction of cells with resultant metabolic demands (Jude *et al*., 2002). Although many conditions have been attributed to cement dust exposure, cement loading remains a lucrative menial job and source of income for able bodied men in our environment, most times without any protective covering. Haematological parameters and white blood cell differentials are sensitive index to changes in ecological conditions and may be useful as a diagnostic tool in studying the toxicity of cement dusts.

This present study was therefore designed to investigate the effect of cement dust on selected haematological parameters and white blood cell differentials of cement loaders in Enugu Metropolis as this has not been previously documented. The outcome of this study will document the haematological dangers of cement dust exposure. It will also help in protecting the cement loaders from possible occupational hazard and in proper management of already exposed workers.

METHODS

Selection of Study Subjects: Sixty (60) adult males aged 25-40 years comprising of 30 cement loaders who have loaded cement for at least 3 years and 30 apparently healthy non-cement loaders (controls) were mobilized for this study. Participants were males who have resided in Enugu metropolis for the last 3 years. Ethical clearance was issued by the Ethical Committee of the University of Nigeria Teaching Hospital (UNTH) Ituku-Ozalla, Enugu and informed consent given by the subjects before the commencement of the study.

Sample Collection

After an oral informed consent, 3.0ml of venous blood samples were collected from each participant into Tri-potassium Ethylene diamine tetracetic acid (K_3EDTA) anticoagulant containers for the analysis.

Sample Analysis

The variables investigated include Haemoglobin (Hb), Haematocrit (Hct), Platelet, Total White Blood Cell (TWBC), Differential White Blood Cell using standard operative procedures as described by Dacie and Lewis (2006). This study lasted for eight weeks between March and May, 2011.

Analysis of Results

Statistical Package for Social Science (SPSS) computer software (version 15) was used for the statistical analysis and the test of significance was calculated using student's *t*-test at 95% confidence limit. *P*-value of (<0.05) was considered as significant and results were expressed as mean ± standard deviation (mean ± SD).

RESULTS

Table 1 shows the mean ± standard deviation (mean ± SD) of haematological parameters of cement loaders compared with controls. The results revealed significant ($p<0.05$) decrease in haemoglobin and haematocrit and a significant ($p<0.05$) increase platelet but, TWBC count showed a non-significant ($p<0.05$) increased when compared with the controls.

Table 1: The mean ± standard deviation (mean ± SD) of haematological parameters of cement loaders and controls

Variables	Cement loaders	Controls	*p*-value
Haemoglobin (g/dl)	12.5 ± 1.03	14.2 ± 0.64	$p<0.05$ *
Haematocrit (l/l)	0.36 ± 0.01	0.42 ± 0.03	$p<0.05$ *
Platelet ($x10^9$/l)	250 ± 22	115 ± 10	$p<0.05$ *
TWBC ($x10^9$/l)	5.7 ± 1.2	5.3 ± 0.7	$p>0.05$

Table 2 represents the mean ± standard deviation (mean ± SD) of WBC differentials of cement loaders compared with the controls. Neutrophil decreased significantly ($p<0.05$) while lymphocyte significantly ($p<0.05$) increased compared to the controls. However, there was a non-significant increased ($p<0.05$) in monocytes and eosinophil when compared with the controls.

Table 2: The mean ± standard deviation (mean ± SD) of White Blood Cell differentials of cement loaders and controls

Variables	Cement loaders	Controls	*p*-value
Neutrophil (%)	35 ± 2.0	56 ± 2.0	$p<0.05$ *
Lymphocyte (%)	60 ± 3.0	40 ± 2.3	$p<0.05$ *
Monocyte (%)	3 ± 1.5	2 ± 0.7	$p>0.05$
Eosinophil (%)	2 ± 1.0	2 ± 0.5	$p>0.05$

DISCUSSION

The present study tested the hypothesis that cement dust exposure affects the haematological parameters of cement loaders. The observed decrease in haemoglobin and haematocrit indicates that cement dust exposure could probably lead to anaemia. This may be as a result of the action of the constituents of the cement dust which includes calcium, silicon and aluminum on the haematopoietic system since chronic exposure to aluminum, one of the major constituent of cement dust could increase lipid peroxidation in different tissues resulting in neurotoxicity, renal failure and anaemia (Mohammadirad and Abdollahi, 2011).

The observed relative lymphocytosis in this study may probably be as a result of the body's defense mechanism to produce more antibodies to combat the inhaled materials which ultimately find their way into the systemic circulation. On the other hand, the observed thrombocytosis recorded in this study could probably be that the constituents of cement dust have stimulatory effects on the bone marrow, leading to increased platelet production or due to the anaemic condition of exposed subjects (Jude et al., 2002). This increase in platelet may probably affect haemostasis if unchecked.

The slightly increased WBC count in the exposed subject suggests a reaction to irritant cement dust lodged in the lungs. This lowered level of Hb, and PCV, and raised WBC and platelet count is an indication that cement dust exposure may have deleterious effect on the bone marrow being the source of the cells (Mojiminiyi et al., 2008) as severe bone marrow lesions have been found in weanling pigs fed with cement klin dust as a way of boosting dietary calcium (Pond et al., 1982). The increased monocyte and lymphocyte count represent a primary disorder of leukocyte production and may reflect a secondary response to some disease process or toxin, whereas the peripheral blood leucocytes count is a marker of inflammatory activity and ongoing tissue inflammation from whatever is the cause (Guguloth et al., 2012). The slight increase in eosinophil may be attributed to increased activation of allergic response. The concentration and length of exposure of cement dust may also have contributed to the observed haematological changes.

CONCLUSION

In conclusion, the present study has demonstrated that cement dust exposure leads to significant decrease in haemoglobin and haematocrit thereby resulting in anaemia. Relative lymphocytosis, neutropenia and thrombocytosis was also observed, all of which are pointers to the fact that cement dust affects the bone marrow leading to the observed haematological effects on the cement loaders.

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