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The Effects of Cement Dust on Haematological Parameters of Cement Workers in Asaba, Delta State, Nigeria

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Cement Dust And Haematological Parameters.

Summary: *The effect of cement dust on exposed workers was conducted in Asaba Delta state Nigeria, to delineate the occupational hazards posed by cement dust on haematological parameters. The assessment of haematological parameters was performed in forty workers occupationally exposed to cement dust and forty matched unexposed control. The accepted level of significance was p< 0.05. The results show that the erythrocyte sedimentation count, haemoglobin concentration and packed cell volume were not significantly different between the exposed and the control (p> 0.05). There was a significantly lower platelet count, lymphocytes and total white blood cell count in the exposed workers relative to the control (p< 0.05). Apart from the white blood cell count, the number of years of exposure did not significantly affect the other parameters.*

The results from this study has shown that occupational exposure to cement dust has significant effects on some haematological parameters while years of exposure was not a significant factor on the haematological parameters of cement depot workers.

Keywords*: Cement exposure, Haematological parameters, Workers, Nigeria.*

I. Introduction

The increased production of cement due to its high demands has led to increased risk of occupational hazard it poses to exposed workers. Production of cement is a dusty industrial process and its effect on the health of workers has been studied for many years (Smailyte *et al,* 2004). Most studies on the effect of cement dust (Alakija et al, 1990; Noor et al, 2000; Laraqui et al, 2001; Al-Neaimi et al, 2001; Meo et al, 2002; Mwaiselage et al, 2005) or granite dust (Azah et al, 2002) exposure in humans have tended to focus on the respiratory system. However, it appears that cement dust exposure may affect other systems such as skin colour, hair colour and haem as well. For instance, the cement industry has the highest number of reported cases of dermatitis and conjunctivitis in Nigeria (Ezenwa, 1996), suggesting that cement dust affects the skin and the eyes. Also evidence from experimental animals suggests that cement dust may have deleterious effects on the liver and bone. Work in mines, quarries, foundries, and construction sites, in the manufacture of cement, ceramics, and abrasive powders, and in masonry workshops are particularly risky (Yang et al,1996). The principal compounds used in the manufacture of cement are a combination of calcium, silicon, iron, and aluminum compounds in the form of limestone and clay (Fairhurst et al, 1997). These elements are detrimental to health if they find their way into the body(Swaran and Vidhu, 2010).

The values of hematological parameters are affected by a number of factors even in apparently healthy populations. These factors include age, sex, ethnic background, body build, social, nutritional and environmental factors, especially altitude (Mohsen et al, 2001). It has been shown in several studies that some of the hematological parameters exhibit considerable variations at different periods of life.

Because of the increasing demand for cement and associated products in Nigeria, there is a need to investigate the health risk of cement dust exposure on the workers. This study therefore investigated the effects of cement dust exposure on the haematological indices of some cement depot workers in Asaba, Delta State, Nigeria.

II. Materials And Method

Study Area:

This research was carried out at Traffic Junction Asaba, Delta State. Delta state is located in the South South geographical zone of Nigeria. The State lies approximately between longitude $5^{o}00$ and $6^{o}.45'$ East and latitude $5^{o}00$ and $6^{o}.30'$ North. It is so centrally located that it has boundaries with five other states. It is bounded in the North and West by Edo State, the East by Anambra, Imo, and River States, South-East by

Bayelsa State, and on the Southern flank is the Bright of Benin. It is a multi ethnic state with the Urobo, Ijaw and Anioma people as the major ethnic groups. Crude oil exploration and agriculture is the mainstay of the economy. The 2006 census preliminary result puts the population of the state at 4,112,445.

Subjects and Methods:

The study was conducted from June to September in 2013 in a cement depot site at Asaba, Delta State. A total of eighty male subjects including forty cement depot workers and forty non-cement workers (control) took part in the study.

Data on the subject's years of exposure was deduced from individual worker. Smokers, alcoholics and people with chronic illness were excluded from the study. The study protocol was prepared in accordance with the Helsinki Declaration and was approved by the Faculty of Basic Medical Science, Nnmadi Azikiwe University, Nnewi campus. Additional approval were sought and obtained from the individual subject. Blood samples (10ml) were also collected from the subjects for hematological parameters. Various parameters such as haemoglobin (HB) estimation, white blood cell count (neutrophils, eosinophils, basophils, lymphocytes and monocytes), platelet counts and packed cell volume (PCV) were estimated using standard haematological techniques as described by Cheesbrough, (2000).

Data Analysis

Mean values for the different data collected in the appropriate groups were calculated and differences between means separated by one way ANOVA. The data analysis was done using SPSS for windows version 16 (SPSS Inc, Chicago .IL). Results are prepared as mean ± SEM in tables.

III. Results

Table 1. Haematological parameters of cement depot workers exposed to cement dust and the control.

	ESR (mm/hr)	HB (g/dl)	PCV (%)	PL (10^9/L)	LYM (%)	NEUT (%)	MON (%)	TWBC ($\times 10^9$)
Exposed N=40	28.20±4.56	13.83±0.31	41.62±0.73	137.15±6.55*	33.70±1.12*	64.50±1.21*	2.94±0.39*	4.82±0.09*
Control N=40	29.47±3.87	13.54±0.37	41.17±1.02	196.45±3.96*	42.85±1 .59*	56.65±1 .68*	2.60±0.21*	6.36±0.27*

Results are mean± SEM. Values with superscripts in a column are statistically significant ($p<0.05$). ESR= Erythrocyte sedimentation rate, HB= Haemoglobin estimation, PCV= packed cell volume, PL= Platelet count, LYM= Lymphocyte count, NEU= Neutrophile count, MON= Monocytes count, TWBC= Total white blood cell count.

Table 2. Comparisons of haematological parameters of cement deport workers based on the rate of exposure.

Rateof exposure (years)	ESR (mm/hr)	HB (g/dl)	PCV (%)	PL (10^9/L)	LYM (%)	NEUT (%)	MON (%)	TWBC ($\times 10^9$)
1-5 N=16	34.06±8.50	13.32±0.52	40.76±1.26	138±13.50	34.43±1.46	62.93±1.94	3.42±0.52	5.05±0.16
6-10 N=15	22.20±7.04	14.38±0.41	42.80±1.07	146.27±9.38	32.93±2.07	65.93±1.99	2.66±0.33	4.84±0.14
≥10 N=9	27.77±7.13	13.81±0.66	41.22±1.59	120.44±3.79	33.66±2.73	64.88±2.60	2.60±0.67	4.40±0.1 5*

Results are mean ±SEM. Values with superscripts in a column are statistically significant ($p<0.05$). ESR= Erythrocyte sedimentation rate, HB= Haemoglobin estimation, PCV= packed cell volume, PL= Platelet count, LYM= Lymphocyte count, NEU= Neutrophile count, MON= Monocytes count, TWBC= Total white blood cell count.

Table 1 represents the haematological parameters of cement depot workers that were exposed to cement dust and the control group that were not exposed. The results show that there were no significant statistical differences between the mean erythrocyte sedimentation count, haemoglobin concentration and the packed cell volume of the exposed workers and the control ($p>0.05$).

The results show that the mean platelet count, lymphocytes and total white blood cell count were significantly lower in the exposed group relative to the unexposed group($p<0.05$) while the mean neutrophile and monocytes were significantly higher in the exposed group relative to the unexposed group ($p<0.05$). Table 2 represents the haematological parameters of the cement depot workers exposed to cement dust based on the rate of exposure in years. The results show that the total white blood cell count of those exposed for more than ten

years was significantly lower than those that were exposed for less than ten years. For the other parameters, the number of years of exposure did not significantly affect their mean values.

IV. Discussion

The increased demand for cement and concrete additives in developing economies for construction activity is associated with increased exposure to cement dust and its accompanying risks. Cement industry is associated with cement dust exposure while high concentration and prolonged inhalation of the dust could provoke clinical symptoms and inflammatory response which may result in functional, structural and other pathologies(Erhabor et al, 2013). In toxicological studies, haematological indices are important parameters for assessing ecological conditions and are therefore sensitive diagnostic tools. The haematological function tests may be useful new parameters in assessing and monitoring the health of cement factory workers in addition to the traditional lung function tests (Mojiminiyi et al, 2008).

The results from this study showed that there were no significant difference on the mean erythrocyte sedimentation rate, haemoglobin estimation and packed cell volume between the exposed group and the unexposed group ($p>0.05$). Our results disagree with some previous results that reported significant reduction in the mean haemoglobin estimation of the exposed group compared to the control (Mojiminiyi et al, 2008; Jude et al, 2002). The results showed no significant changes in the haemoglobin estimation and packed cell volume between the two groups. The results of Mohammed and Sambo, (2008) showed a fall in these parameters of the Nile Tilapia in water treated with cement dust. The report of Hauser et al. (1995) showed a marked reduction in the haemoglobin values of exposed workers relative to the control. Also our results on Haemoglobin concentration and packed cell volume did not support the findings of Ogunbileje and Akinosun (2011) that cement dust adversely affected the biochemical and haematological parameters of animals. The report of Erhabor et al, (2013) showed decreased mean PCV in exposed workers which was at variance to the report of Ogunbilije and Akinosun (2011) that reported increased mean serum packed cell volume in the exposed worker compared to the unexposed controls. Low packed cell volume is indicative of a low amount of red blood cells per unit volume and anaemia.

We reported a non significant increase in the mean ESR of the exposed group relative to the unexposed control. The results of Erhaboor et al. (2013) indicated a significantly higher erythrocyte sedimentation rate among exposed workers relative to the unexposed controls. The ESR is a simple inexpensive valuable tool for diagnostic purposes and to measure inflammation. The ESR remains fairly constant in healthy subjects and is affected by properties of the erythrocytes and plasma (Sultane et al, 2002; Erhabor et al, 2013). A relatively high ESR is often associated with an infectious disease or a significant amount of tissue necrosis(Kirkeby et al,1989).

There was significant decrease in the platelet count of the exposed group when compared with the control group, ($p<0.005$) in line with the study conducted by Jude et al, (2002) which reported significant reduction in platelet count of the exposed group. They stated that the reduced platelet count may be due to anaemic condition in the subjects. Mojiminiyi et al, (2008) and Erhabor et al, (2013) however reported an increase in the platelet count of exposed subjects. It is not clear why this disparity in findings. This difference in results may be due to racial factors or variation in duration of exposure to cement dust and number of samples analyzed. High platelet count observed in some reports was attributed to inflammation. High platelet count can also increase when relative proportion of the body tissue is exposed to toxins (Erhabor et al, 2013).

There was significant decrease in the lymphocyte count of the exposed group when compared with control group ($p<0.005$), in contrast to the report of Mohan et al. (2012) which showed that total lymphocyte count was found to be significantly higher in cement workers than the healthy control. Also Jude et al. (2002) reported significant increase in the total lymphocyte count.

There was significant increase in the neutrophil count of test group when compared to control group, ($p <0.005$). However, according to Jude et al. (2002) the count of neutrophils did not reveal any statistically significant alteration between the test and control groups while Yahaya et al. (2011) reported lower neutrophil count in cement factory workers compared with the control in line with our results.

Also, there was a significant decrease in the total white cell count of test group ($p<0.001$). This is in variance with previous works (Jude et al, 2002; Mojiminiyi et al, 2008; Erhabor et al, 2013) which revealed increase in the mean leukocyte count of the exposed subjects over the control but agrees with the results of Yahaya et al, (2011) that reported significant reduction in total white blood cell count. High white blood count represents a primary disorder of leukocyte production or may reflect a secondary response to some disease process or toxins. White blood cell count is often seen as a marker for inflammatory response. Changes in the number of circulating leukocytes can represent a primary disorder of leukocyte production or may reflect a secondary response to some disease process or toxin (Schwartz and Weiss, 1991). Raised white blood cell count in some reports probably reflects a reaction to irritant cement dust lodged in the lungs(Mojiminiyi et al, 2008). From the results in Table 2 that compared the haematological parameters with years of exposure, we observed a significant decrease in the total white blood cell count only at >10 years of exposure ($p<0.05$). The report of

Erhabor et al, (2013) showed that there was an increase in white blood cell count regardless of the period of exposure. For the other parameters, the duration of exposure did not have significant effect on their serum levels ($p>0.05$). Frequency of 1-5 years and 6-10 years in the test groups were almost the same; while >10 years was far less. Hence, it could be said that the harmful effects of exposure to cement dust would gradually accumulate overtime with little or no manifestations within the first few years of exposure and would only manifest with symptoms like chest-pain, when the years of exposure is quite significant. Duration of exposure, therefore, should be considered together with other interfering factors in delineating the hazards caused by cement dust.

V. Conclusion

The results from this study has shown that occupational exposure to cement dust has significant effects on some haematological parameters while years of exposure was not a significant factor on the haematological parameters of cement depot workers. We recommend that workers exposed to cement dust should be provided with protective materials while routine medical checks should be encouraged.

References

[1]. Alakija, W., Iyawe, V.I., Jarikre, L.N. and Chiwuzie, J.C. (1990): Ventilatory function of workers at Okpella Cement Factory in Nigeria. West African Journal of Medicine; 9(3): 187- 192.

[2]. Al-Neaimi, Y.I., Gomes, J. and Lloyd, O.L. (2001): Respiratory Illnesses and Ventilatory Function among Workers at a Cement Factory in a Rapidly Developing Country. Occup. Med.; 51 **(**6):367-373.

[3]. Azah, N., Antai, A.B., Peters, E.J. and Osim, E.E. (2002): Effect of exposure to dust generated from crushing of granite rocks on the lung function of south eastern Nigerian children. Niger. J. Physiol. Sci.; 17 (1-2): 42-47.

[4]. Cheesbrough, M.(2000): District Laboratory Practice in Tropical Countries. Part 2. Cambridge University Press, United Kingdom, 299- 324.

[5]. Erhabor O, Kebbe B.I., Isaac, I.Z., et al. (2013): Effect of occupational exposure of cement dust on some haematological parameters of workers in a cement company in Sokoto, Nigeria. International Journal of Medical Science and Health Care;1(7):21-25.

[6]. Ezenwa, A.O. (1996): A study of the prevalence of occupational diseases and the factors affecting their identification and reporting in Nigeria. Nig. Med. J; 31:12-14.

[7]. Fairhurst ,E.J Mohanty, G.P, Harrison, C.V. and Negelschmith, G (1997):The action of different form of pure silica on lungs of rats. British Journal of Industrial Medi ci ne;1 0,9-17.

[8]. Hauser, R., Elreedy, S., Hoppin, JA. and Christiani, D.C. (1995):Upper Airway Response in Workers Exposed to Fuel Oil Ash: Nasal Lavage Analysis. Occup. Environ. Med; 52: 353-358.

[9]. Jude, C.A.L., Sasikala, K., Ashok Kumar, R., Sudha, S. and Raichel, J. (2002) : Haematological and cytogenetic studies in workers occupationally exposed to cement dust. Int. J. Hum. Genet; 2(2): 96-99.

[10]. Kirkeby, O. J., Risoe, C., Vikland, R. (1989): Significance of a high erythrocyte sedimentation rate in general practice. B.J.C.P; 143: (7) 252-254.

[11]. Laraqui, C.H., Laraqui, O., Rahhali, A., Harourate, K., Tripodi, D., Mounassif, M. and Yazidi, A.A. (2001) : Prevalence of Respiratory Problems in Workers at two Manufacturing Centers of Ready-made Concrete in Morocco. I nt. J. Tuberc. Lung Di s; 5(1 1):1051-1058.

[12]. Meo, S.A., Azeem, M.A., Ghori, M.G. and Subhan, M.M. (2002): Lung Function and Surface Electromyography of Intercostal Muscles in Cement Mill Workers. Int. J. Occup. Med. Environ. Health; 15(3): 279-287.

[13]. Mohan R.G; Sambanaik, A ; Sri nivasnaik, L and Jagadishnaik, M (2012): The Effect of Cement Dust Exposure on Haematological Parameters of Cement Factory Workers International. Journal of Advancements in Research and Technology Research; 33:379-385.

[14]. Mohsen A.F., El-Haz. and Arjumand , S.W. (2001): Normal Reference Values for Hematological Parameters, Red Cell Indices, Hb A2 and Hb F From Early Childhood Through Adolescence In Saudis, Ann Saudi Med; 21 (3-4):165-169.

[15]. Mojiminiyi, F.B.O, Merenu, I.A, Ibrahim, I.J.A and Njoku, C.H. (2008): The Effect of Cement Dust Exposure on Haematological and Liver Function Parameters of Cement Factory Workers in Sokoto, Nigeria. Nigerian Journal of Physiological Sciences; 23 (1- 2): 111 -114.

[16]. Mohammed, A.K. and Sambo, A. B. (2008): Haematological assessment of the nile tilapia Oreochromis nilaticus exposed to sublethal concentration of Portland cement powder in solution. Int. J. Zool. Res; 4: 48-52.

[17]. Mwaiselage, J., Bratveit, M., Moen, B. andYost, M. (2005): Variability in dust exposure in a cement factory in Tanzania. Annual Occupational Hygiene. 49(6):511-519.

[18]. Noor, H., Yap, C.L., Zolkepli, O. and Faridah, M. (2000): Effect of Exposure to Dust on Lung Function of Cement Factory Workers. Med. J. Malaysia; 55(2): 51-57.

[19]. Ogunbilleje, J.O. and Akinosun, O.M.(2011): Biochemical and haematological profile in Nigerian cement factory workers. Research Journal of Environmental Toxicology; 5: 133-140.

[20]. Schwartz, J. and Weiss, ST.(1991): Host and environmental factors influencing the peripheral blood leukocyte count. Am J Epidemiol; 134: 1402-1409.

[21]. Smailyte G, Kurti nati s, G. and Andersen, A .(2004): Mortality and Cancer incidence among Lithuanian Cement Producing Workers. Occup.Environ Med; 61:529-534.

[22]. Sultane, A., Meoos, Muhammad A Azeem, Shoukate A Arian, Merza M Subhane. (2002): Haematological changes in cement mill workers. Saudi Medical Journal; Vol. (11): 1386-1389.

[23]. Swaran J.S. and Vidhu, P.(201 0): Chelati on in Metal Introduction Int. Journal Environ. Res. Public Health; 7(7): 2745 - 2788.

[24]. Yahaya T, Okpuzor, J and Adedayo T. F.(2011): Investigation of General Effects of Cement Dust to Clear the Controversy Surrounding its Toxicity. Asian Journal of Scientific Research; 4: 315-325.

[25]. Yang, CY., Huang, CC., Chiu, H.F, Chiu, J.F, Lan, S.J. and Ko, YC.(1996): Effects of Occupational dust exposure on the respiratory health of Port Land Cement workers. Journal of Toxically Environment Health; 49: 581-588.