Effects Of Different Cement Factory Sections Products On Immunoglobulin Levels And Some Biochemical Parameters In Nigeria Cement Factory Workers.

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Abstract: Cement dust emission into the environment from various points is a major pollution problem in cement factory, with cement dust constituent differing at each point of production, therefore, suggesting toxicity implications at each points of production might differ. The present study determines the levels of serum immunoglobulin classes (IgA, IgG, IgM, IgG) and total bilirubin, alkaline phosphatase(ALP), aspatase aminotransferase (AST), alanine aminotransferase(ALT), total protein, albumin, creatinine, uric acid and gamma glutamyl transferase in forty five(45) cement factory workers working in different sections of the factory (Crushing (13) , Milling(19) and Packing sections (13)). Immunodiffussion method was used to determine serum IgA, IgG, IgM while ELISA method was used to determine serum IgE. Alkaline phosphatase(ALP), alanine amino transferase(ALT), aspatase aminotransferse, total bilirubin, albumin, creatinine and uric acid were determined using Hitachi 902 auto analyser while gamma glutamyl transferase (GGT) was determined using colorimetric method. The levels of IgM, IgA and IgE were not statistically different among the groups ($p>0.05$) while IgG was significantly higher in workers working in the packing section of the factory ($p<0.05$) when compared with the other two sections. Also, total bilirubin, albumin, AST, ALT, ALP were significantly higher ($p<0.05$) in workers at the crushing section, uric acid is also significantly higher in workers at the milling section ($p<0.05$) but creatinine and GGT were not significantly different ($p>0.05$) though with a higher mean levels when compared with the general population. This study demonstrated that workers in cement factory working in different sections are susceptible to various diseases specific to their work area. [Effects Of Different Cement Factory Sections Products On Immunoglobulin Levels And Some Biochemical Parameters In Nigeria Cement Factory Workers.

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INTRODUCTION

Production of cement is a dusty industrial process and the healths of the workers have been studied for many years (Smailyte et al, 2003). Silica which is a major constituent of cement dust has been mostly implicated to cause or contribute to several diseases including acute silicosis, pulmonary tuberculosis, interstitial fibrosis, rheumatoid complications, vascular disease, cancer, glomerulonephritis and immunological reactions

(Rapiti et al, 1999; Ding et al, 2002; Smailyte et al, 2003; Mao et al , 2009; Ogunbileje et al, 2010).

Basically, the sections in cement factory can be grouped into crushing, milling and packing sections and each of these sections are known to differ in releasing different toxic constituents (Ogunbileje et al, 2010) with the introduction of various additives and via different mechanical processes (ground work, 2008; Ogunbileje et al, 2010). These constituents (such as chromium and silica) stimulates inflammatory responses from workplace exposures and result in specific target organs derangement such as the lungs, skin, liver and the immune system might be affected (Fell et al, 2003; Omini and Akpogomeh, 2007; Mojimoniyi et al, 2007; Ogunbileje et al, 2010).

The present investigation was specifically designed to determine the section of the cement factory that is most likely more affected by toxic constituents at each point of production by examining some humoral immune system parameters, liver function tests, renal indicator and uric acid as a marker of genotoxicity.

MATERIALS AND METHODS

Forty-five (45) males were randomly selected among the workers of a cement factory situated in Ogun State, Nigeria. These personnels working at the crusher, milling, and packing sections were selected after filling informed consent form. They were grouped according there sections; Group 1(Crushing section (13)), Group 2 (Milling section (19)) and group 3 (Packing section (13)) with a mean years of exposure of 11.6years, 5.3years and 4.8years respectively. Five (5) millilitre of venous blood was withdrawn into a plain sample bottle, allowed to retract and spun at 3000rpm for 5min to obtain serum. Serum IgA, IgG, IgM were estimated using radial immunodiffusion method (Salimonu et al, 1978) while IgE was determined using ELISA method using Human IgE MICRO-ELISA Test kit (Leico Technologies, Inc). ALP(EC:3.1.3.1), ALT(EC:2.6.1.2), AST(EC:2.6.1.1) total bilirubin, albumin, uric acid, creatinine were determined using Hitachi 902 auto analyser while GGT (EC:2.3.2.2) was determined using colorimetric method using commercially prepared kit (Fortress diagnostics).

Statistical analysis: Computer software SPSS version 15.0 was used for analysis of data. Comparisons of variables were done using F-test. The probability value (p) less than 0.05 was considered significant.

RESULTS

Table I shows the serum levels of immunoglobulin in cement factory workers working in different sections of the factory. IgA, IgM, IgE mean levels are not statistically different ($p>0.05$) among the three groups in the factory while IgG was significantly higher ($p<0.05$) in workers working in the Packing section.

Also as shown in table II, creatinine though not significantly different among the groups, the mean level is higher in workers in all section than the average mean for the general populace. While total bilirubin, ALP(EC:3.1.3.1), AST(EC:2.6.1.1), ALT(EC:2.6.1.2), ALB mean levels are significantly higher in workers working in the Crushing section when compared with the other two sections, also uric acid mean level is significantly higher in workers in the Milling section of the factory but GGT(EC:2.3.2.2) is significantly different.

Table I: Serum Immunoglobulin levels in worker working in different sections of cement factory

Immunoglobulin	Crusher	Millers	Packers	F-values	Significant
N	13	19	13		
IgA	238.62±75.93	212.24±89.30	227.05±88.83	0.377	p>0.05
IgG	905.26±467.60	698.04±159.87	1059.73±335.89	4.94	P<0.05
IgM	727.15±1861.21	730.86±1590.28	207.00±223.56	0.60	p>0.05
IgE	766.08±325.05	710.84±353.98	630.69±553.63	0.352	p>0.05

Table II: Serum levels of some biochemical parameters in cement factory workers working in different sections of the factory.

Analytes	Crusher	Millers	Packers	F-values	p-values
N	13	19	13		
T.bilirubin	1.08±0.48	0.92±0.37	0.72±0.25	3.11	p<0.05
ALP(3.1.3.1)	108.54±29.88	90.42±16.42	88.0±16.81	3.79	p<0.05
AST(2.6.1.1)	40.62±23.15	33.00±7.92	22.54±6.80	5.56	p<0.05
T.prot	13.78±20.54	7.58±1.49	7.70±0.36	1.44	P>0.05
ALB	4.45±0.93	3.49±0.99	4.15±0.31	5.56	P<0.05
CRT	1.73±1.30	1.87±1.67	1.27±0.12	0.87	p>0.05
URIC ACID	4.82±1.18	6.91±1.56	4.79±0.86	14.65	p<0.05
GGT(2.3.2.2)	19.84±13.76	15.00±6.72	24.23±15.36	2.37	p>0.05
ALT(2.6.1.2)	19.31±10.90	19.00±6.82	10.38±4.27	5.98	p>0.05

DISCUSSION

Cement industry is considered as a major pollution problem because of dust and particulate matter emitted at various steps of cement production. The workers are usually exposed to dust through dermal, respiratory routes and to a lesser extent via ingestion. The increased IgG in workers in workers at Packing section suggest that this might be due to exposure to fine silica particles. Silica exposure has been reported to be associated with elevated IgG which is usually more pronounced over IgM (Doll et al, 1981; Karnick et al, 1990; Nagaoka et al, 1993; Huange et al, 2001 and Ogunbileje et al, 2010). Huange et al (2001), reported a consistent increased IgG in silica exposed animal group compared with other groups exposed to various toxicants. Ogunbileje et al (2010), further explained that this might be due to a mechanism to prevent anaphylactic reactions at every exposure to allergen (silica), thus, IgG helps protect against IgE mediated immunopathology (Strait et al, 2006; Ogunbileje et al, 2010).Though, IgE mean levels in workers working in crushing section is not statistically significant, it tend to be higher than the mean level reported in Nigeria men (Arinola, 2008).This might be due to their long years of exposure to quartz.

The significant higher ALP (EC: 3.1.3.1), total bilirubin, AST (EC; 2.6.1.1), ALT(EC: 2.6.1.2) and albumin levels probably suggest that workers working in crushing section are more susceptible to hepatic damage. These set of workers are involved in quarrying gypsum, limestone and other raw materials been used in the cement factory crushed into specified diameters. Thereby supporting the reports of Doig (1955), Rapti et al (1999). It can therefore be inferred, that workers exposed to silica without other additives use at Milling sections are also susceptible to hepatic damage. This might support the hypothesis that crushed quartz is more cytotoxic than aged quartz by driving the release of oxidant production (Rapiti et al, 1999).

Several reports have linked exposure to Cr (VI) to lung cancer, asthma, nasal septum ulcerations and perforations, skin ulcerations and chromosomal aberrations (Jude et al, 2002; Padmaja et al, 2002; Fiore, 2006). Uric acid is significantly higher in workers working at the Milling section at which point chromium is been majorly introduced into cement production this might support the report that uric acid may be a consistent and reliable biomarker of significant exposure to toxicant (Gittelman et al, 1994). Also, uric acid also acts as a repair agent of oxidative damage to DNA bases (Simic and Jovanic, 1989) and it has been inversely correlated with the marker of genotoxicity, 8-deoxyguanosine, thus suggest reduced risk of genetic damage (Anetor et al, 2009). Though, there is no significant difference in creatinine mean levels among the groups but it's higher in all groups than reference range after corrected for age and sex.

There are limitations in this study. The sample size is relatively small; a larger population of cement factory workers may be needed to be investigated. Also, workers from the different sections have not spent equal years in service; this is because most workers at the Packing and Milling sections are on contract employment, they therefore spend fewer years in the company.

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REFERENCE

1. Anetor J.I, Yaqub S.A, Anetor G.O, Nsonwu A.O, Adeniyi,F.A.A and Fukushima S. (2009).Mixed chemical –induced oxidative stress in occupational exposure in Nigerians. *African Journal Biotechnology2009; 8:821-826*
2. Arinola O.G 2008.Serum Total IgE levels in healthy children and adults in Ibadan ,Nigeria. *Tanzania Medical Journal 2008,23;2:9-10*.
3. Ding M, Chen F, Shi X, Yucesory B, Mossman B, Vallyathan V. Diseases caused by silica: mechanisms of injury and disease development. *International Immunopharmacology. 2002; 2:173-182*
4. Doig A.T (1955). Disabling Pneumoconiosis from Limestone dust, Br. J. Ind ; 12: 206-216.
5. Doll N.J., Stankus R.P., Hughes J, Weill H., Gupta R.C., Rodriguez M., Jones R.N., Alspaugh,M.A.,Salvaggio,J.E(1981).Immune complexes and autoantibodies in silicosis.*J.Allergy Clin Immunol 1981;68:281*
6. Fell AK, Thomassen TR, Kristensen P, Egeland T, Kongland J. Respiratory Symptoms and Ventilatory Function in Workers Exposed to Portland Cement Dust,*JOEM 2003; 45:1008-1014*
7. Gittleman B, JL, Enelgau MM, Shaw J, Willie KK, Seligman PJ (1994). Lead poisoning among battery reclamation workers in Alabama. JOM 36:526-532.
8. Jude A.L.C. , Salikala K ., kumar R.A. , Sudha S., Rachel J.(2002). Haematological and cytogenetic studies in workers occupationally exposed to cement dust .*int.j.Genet,2,(2):95-99.*
9. Karnick AB, Saiyed HN, and Nigam SK. Humoral immunologic dysfunction in silicosis. *Indian J Med Res 1990; 92:440.*
10. Meo S. A, Rasheed S., Khan M.M , Shujauddin S., Al-tuwaijri A. (2008).Effect of cement dust exposure on phagocytic function of polymorphonuclear neutrophils in cement mill workers.*International Journal of Occupational Medicine and Environmental Health2008;21(2):133-139.*
11. Mojimoniyi FBO, Merenu IA, Njoku CH, Ibrahim MTO. Regression Formulae for Predicting Hematologic and Liver Functions from Years of Exposure to Cement Factory Workers in Sokoto, Nigeria. *African Journal of Biomedical Research 2007; 10:235-240.*
12. Nagaoka T., Tabata M., Kobayashi K., and Okada A. (1993). Studies on production of anticollagen antibodies in silicosis. *Environ Res 60; 12-29*
13. Ogunbileje J.O, Akinosun O.M, Arinola O.G , Akinduti P.A(2010). Immunoglobulin Classes (IgG, IgA, IgM and IgE) and Liver Function tests in Nigerian Cement Factory Workers, *Researcher 2010;2(4):55-58*
14. Ogunbileje JO, Akinosun OM, Akinduti P.A, Nwobi L.A, Ejilude O.A. Serum Levels of Some Trace Metals and Leucocyte Differential Counts in Nigeria Cement Factory workers: Possible Toxicity Implications; *Florida Int. Journals (in press).*
15. Omini OI, and Akpogomeh BA. . The effect of Limestone, Crush Rock and Asbestos /cement dust particles on the Ventilatory function parameters of chronically exposed workers in Calabar municipality and Akampka Local Goverment Areas of Calabar ,Cross River State, Nigeria. *Journal of Medical laboratory Sciences2007; 16:1-3* (14)
16. Pournourmohammadi S., Khazaeli P, Eslamizad A., Tajvar A, Mohammadirad A. and Abdollahi M. (2008). Study on the oxidative stress status among cement plant workers. *Hum. Exp. Toxicol. 27:463-469.*
17. Revoltella R and Ovary Z (1973). Competitive effect of homologous IgG or Fc in sensitization of rabbits for PCA mediated by reaginic antibody. *J. Immuno 111:698).*
18. Salimonu LS, Ladipo OA, Adeniran SO and Osunkoya BO. Serum Immunoglobulin levels in normal premature newborns and their mothers.*Int.J.Gynaecol obst 1978; 16:119-123*
19. Simic MG, Jovanic SV (1989). Antioxidant mechanisms of uric acid. *J. Am. Chem. Soc. 111: 5778- 5782.*

20. Smailyte G, Kurtinaitis G and Andersen A (2004).Mortality and Cancer Incidence among Lithuanian cement producing worker. *Occup. Environ Med.; 61: 529-534.*
21. Smailyte G., Kurtinaitis K., Andersen A. (2004). Mortality and Cancer incidence among Lithuanian cement producing workers. *Occup Environ. Med. 61:529-534*
22. Strait RT, Morris SC, Finkelman FD.IgG-blocking antibodies inhibit IgE-mediated anaphylaxis in vivo through both antigen interception and FcγRIIb cross-linking.*J.Clin.Invest 2006; 116(3):833-841*
23. Rapiti E, Sperati A, Miceli M. (1999). End stage renal disease among ceramic workers exposed to silica. *Occup. Environ. Med. 56:559-561.*

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