IMMUNOGLOBULIN CLASSES (IgG, IgA, IgM and IgE) AND LIVER FUNCTION TESTS IN NIGERIAN CEMENT FACTORY WORKERS

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Abstract: Crystalline silica has recently been reported to act as an adjuvant which increases inflammation and antibody production. On the basis of new knowledge, it is possible that cement dust may have effects on the immune functions of cement factory workers. Previous studies on Nigerian cement factory workers were concentrated on the pulmonary function tests, chronic obstructive pulmonary disease (COPD), prevalence of chest infections and liver function tests neglecting the immune parameters of the cement workers. The present study determines the levels of serum immunoglobulin classes (IgA, IgM, IgG & IgE) and Alanine aminotransaminase, Alkaline phosphatase, total bilirubin and gamma glutamyl transferase in 45 male cement factory workers that are occupationally exposed to cement dust compared with 30, age and sex-matched, office workers that were not resident in the town of study. Immunodiffusion method was used to determine serum IgA, IgM, IgG while ELISA method was used to determine serum IgE. Alkaline phosphatase(ALP), alanine amino transferase(ALT), bilirubin were determined using Hitachi 902 auto analyser while gamma glutamyl transferase(GGT) was determined using colorimetric method. The levels of IgM and IgA were not statistically different in cement factory workers compared with control ($p>0.05$) while IgG and IgE were significantly higher in cement factory workers ($p<0.05$) when compared with corresponding levels in the controls. Also, ALP and bilirubin were higher in the test subjects than in control group ($p<0.05$). Though the mean levels of ALT and GGT were not statistically significantly higher cement factory workers when compared with control group ($p>0.05$). This study demonstrated that higher level of IgG may be a mechanism to block anaphylaxis reaction of IgE in Nigerian cement factory workers. The raised ALP and bilirubin levels may suggest hepatotoxic effects of cement dust. [Researcher 2010;2(4):55-58]. (ISSN: 1553-9865).

Key-words: Silica, Cement dust, Nigeria, Immunoglobulin, Liver.

INTRODUCTION

Cement is known to be a mixture of calcium oxide (60-67%), silicon oxide (17-25%), aluminium trioxide (3-8%), and ferric oxide (0-5%) (Fell et al, 2003), and is been implicated as a causative agent of silicosis. Silicosis is one civilization's oldest known occupational disease, and is induced by inhalation of crystalline silica (Ding et al, 2002). Exposure to silica can result in or contribute to several other diseases including acute silicosis, pulmonary tuberculosis, interstitial fibrosis, rheumatoid complications, vascular diseases, glomerulonephritis, and immunological reactions (Ding et al, 2002). Though inflammatory responses resulting from workplace exposures are usually observed in specific target organs, such as the lungs, skin and liver and if persistent, may progress to fibrosis, granulomatous diseases and even cancer (Aminian et al, 2008). On the basis of new knowledge, it is possible that cement dust may have effects on the immune and liver functions.

Silica is a major constituent of cement dust and has been reported to be one of the most fibrogenic material found in nature (ICMR, 2001).The reason for the fibrogenic property remain largely unelucidated. Though, this has been related to the role of immunological phenomenon in the pathogenesis of this disease. ICMR (2001) proposed a theory which suggests three possible ways in which free silica particles might cause immunological reactions viz: silica acting as an antigen, producing an autoantibody or acting as an adjuvant. This is also consistent with the report of Pernis (2001), which proposed that the pathogenesis of silicosis may be entirely immunological and that it involves stimulation of innate immune system, followed by polyclonal activation of the lymphoid and adaptive moiety of immunity. Though, the respiratory tract is often the site of injury in occupationally exposed individuals but the kidney, liver, skin and the immune system may be affected. The incidence of autoimmune disease has also been reported in several studies (Sanchez-Roman et al, 1993 and Boll et al, 1981). Increased levels of different immunoglobulin classes have been reported in

previous studies on the effects of silica on immunoglobulin classes (Gregorid et al, 1980, Doll et al, 1980, Doll et al, 1981 and Karnick et al, 1990). However, increased IgG level has been consistent in most studies (Galikova, 1982, Karnick, 1990). Previous studies on cement factory workers in Nigeria were concentrated on its effects on the prevalence of chest infections and liver function tests, neglecting the immune parameters of the cement workers (Omini and Akpogomeh, 2007 and Mojimoniyi et al, 2007). Encountered studies on immune functions and environmental exposure to substances among Nigerians were not on cement factory worker (Akinosun et al, 2006, Arinola and Obikoya, 2008). This reason therefore, necessitated the determination of levels of some humoral parameters and liver function in Nigerian cement factory workers.

MATERIALS AND METHODS

A total of seventy-five (75) Nigerian males were recruited for the study after obtaining an informed consent. Forty-five (45) were cement factory workers while thirty (30) controls were office workers that are not resident in Sagamu town (town of study). Smokers, alcoholics and those with chronic illnesses were exempted from the study. The mean age of the subjects group was 35.04±8.36 years while that of the control group was 31.87±8.08years. Questionnaires were administered to obtain other information.

Five (5) millilitres 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^{R} (Leico Technologies, Inc). ALP, ALT, bilirubin were determined using Hitachi 902 auto analyser while GGT was determined using colorimetric method.

Statistical analysis: Computer software SPSS version 15.0 was used for analysis of data. Comparison of variables were done using Student t-test and Pearson correlation. The probability value (p) less than 0.05 was considered significant.

RESULTS

Table I shows the mean levels of immunoglobulin classes in cement factory workers compared with corresponding levels in controls. IgG and IgE were significantly higher in cement factory workers ($p<0.05$) when compared with corresponding levels in the controls. The mean level of IgM of cement factory workers was lower compared with control but not statistically significantly ($p>0.05$), also IgA mean levels was non-significantly higher in cement factory workers compared with controls ($p>0.05$). In table II, ALP and bilirubin were significantly higher in the test subjects than in control group ($p<0.05$). Though, ALT and GGT have higher mean levels in cement factory workers compared with controls but the levels were not statistically significant ($p>0.05$).

Table I: Immunoglobulin levels in Nigerian cement factory workers and controls.

	N	IgA (mg/dL)	IgM (mg/dL)	IgG (mg/dL)	IgE (iu/ml)
Control	**30**	**191.45 ±86.31**	**1265.45± 2262.98**	**594.64± 198.49**	**411.90± 454.49**
Cement factory workers	**45**	**224.14 ±86.31**	**578.45±1 431.89**	**862.39± 352.94**	**703.64± 407.94**
t-values		**1.629**	**1.612**	**3.771**	**2.898**
P		**p>0.05**	**p>0.05**	**P<0.05**	**p<0.05**

Table II: Some liver function parameters in Cement factory workers and controls.

	N	ALP(iu/L)	GGT(iu/L)	T.BIL(mg/dl)	ALT(iu/L)
Control	**30**	**82.30± 25.98**	**14.77± 7.73**	**0.70±0.31**	**15.77± 8.2**
Cement factory workers	**45**	**94.96± 22.55**	**19.07± 12.23**	**0.90±0.40**	**16.60± 8.51**
t-values		**2.240**	**1.709**	**2.392**	**0.421**
p-values		**p<0.05**	**p>0.05**	**p<0.05**	**p>0.05**

DISCUSSION

The complex cellular interactions involving cells of the immune system, inflammatory and haematopoietic systems evolved to protect vertebrates from foreign invaders (Arinola and Obikoya, 2008). Silica is believed to be one of the most fibrogenic material found in nature (ICMR, 2001), and thus triggers a host of inflammatory reactions resulting in the secretion of cytokines, lytic enzymes, chemotatic factors, reactive oxygen species and eicosanoids. Though, this immunomodulatory process has not been fully elucidated. The significant higher IgE suggests allergy response of these workers to cement dust, which if persistent may result in systemic anaphylactic reaction. The increased IgG along with IgE probably support the hypothesis that allergen immunotherapy inhibits allergy, in part, by inducing production of IgG antibodies that intercept allergens before they can cross-link mast cell FcεRI-associated IgE (Strait et al, 2006). The interaction between antigen anaphylactic (reagenic) antibody at the mast cell or basophil surface results in the degranulation of these cells and thus the release of a variety of pharmacological active agents, including histamine and serotonin. The effect of these amines on tissues such as bronchial smooth muscle and vascular endothelium produces many of the symptoms of atopic conditions (Lynch et al, 1978). To prevent this reaction at every exposure to allergens, evidence has suggested that IgE and IgG antibodies interact with the mast cells at a common Fc receptor (Revoltella and Ovary, 1973). Also, Strait et al (2006) provided evidence that direct in-vivo allergen–specific IgG blocking antibodies can help protect against IgE mediated immunopathology. The increased IgE and IgG is consistent with other studies (Rosenthal et al, 1998 and Tulinska et al, 2004). It is probable that slightly raised IgA mean level in cement factory workers suggest stimulation of respiratory tracts by inhaled particulate matters. The significant higher ALP and total bilirubin levels probably confirm the hypothesis of the involvement of hepatic damage due to exposure to toxic constituent of cement production. The elevated ALP is not in agreement with other reports on cement factory workers in Nigeria (Morenu, 1993 and Mojimoniyi et al, 2007); they reported a significant lower ALP. The elevated mean level of GGT, though not significant, probably suggests that the elevated ALP is of hepatic origin. GGT is a sensitive marker of hepatobiliary disease and it is closely correlated with serum alkaline phosphatase levels (Reddy and Faust, 2006). This study suggests inflammatory and hepatotoxicity of cement dust in Nigeria cement workers.

CONCLUSION

Alteration in the humoral immune system and its implications in the evolution and pathogenesis of a number of non communicable diseases are evident in this study. Though, the body homeostatic system tends to prevent the progression of the tending pathological conditions but this is dose dependent. The hepatotoxic effects of cement dust and the possibilities of developing autoimmune diseases might be exacerbated if the exposure to this dust is not controlled. Therefore, it is advisable that mutual collaboration should be established between health officials, cement mill workers and their management to adopt technical preventive measures.

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