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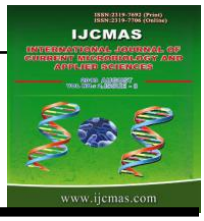


**Original Research Article**

# A Case Study on Heamatological Parameters and Immune System Alterations in Granite Workers

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**Keywords**

Granite workers, Heamatological parameters, IgE, ELISA method, Allergic reactions

**A B S T R A C T**

This study was carried out in the area of serkkadu in vellore district. In this study a group of 120 workers were selected with age ranging from 21-30, 31-40, 41-50 and 51-60 years. The blood samples were taken from them and estimation of haemoglobin (Sahli's method), Total leucocyte count, Erythrocyte sedimentation rate (Westergren's method) and IgE (ELISA method) were analysed. The results shows that the mean values of Hb and TLC of dust exposed workers from age group of 21-60 has less significant compared to normal workers. The probability of differential eosinophil count, Absolute eosinophil count and Ig E of dust exposed workers from different age groups of 21-60 shows highly significant compared to normal workers. The idea was to identify a simple and costs effective screening test that could help in identifying the presence of disease in granite stone cutting workers potentially related to their workplace.

## Introduction

Due to Globalization and high level of industrialization, there has been an increase in the demand for granite and granite related products. The consequence of uncontrolled use of granite (stone cutting) are pollution of the environment especially workers (Srianujata.,1998). A wide spectrum of colours, texture and toughness of granite make it as a preferred construction stone throughout the world. Globally, there are nearly 300 varieties of granite and India produces more than 160 varieties. It is estimated that granite resources in India are very large which can last for hundreds of years to meet demand – both domestic and export. This means granite quarrying, saw milling, cutting, polishing and civil installation will continue long in this country. Occupationally generated granite dust mainly contains silica and the common disease in granite workers has been diagnosed as silicosis worldwide (Koskela*et al.,* 1994). Deterioration of lung function as well as cancerof lung and kidney has also been documented in granite workers (Attfield and Costello 2004). When exposed to even low levels of granitedust over a long period of time, there is a potential health

riskfor different types of serious respiratory illnesses (Malmberg*et al.*,1993). 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, granolomatous diseases or even (Micheal IL and Meryl HK 2002). Occupational exposure to crystalline silica dust has been examined as a possible risk factor with respect to several systemic auto immune diseases, including rheumatoid arthritis, scleroderma, systemic lupus erythematosus and some of the small vessel vasculitis with renal involvement (Sanches*et al.*,1993).Hypergammaglobulinemia, the presence of autoantibodies and circulating immune complexes have been demonstrated in mineral dust exposed workers who have developed mineral dust-related disorders (Basaran and Shubair 2002).

Dust allergies in the workers of granite (stone cutting workers) are a significant problem all over the world (Rom W 1998). An allergy is a hypersensitivity disorder of the immune system. Allergic reactions occur when a person's immune system reacts to normally harmless substances in the environment. A substance that causes a reaction is called an allergen. These reactions are acquired, predictable and rapid. Allergy is one of four forms of hypersensitivity and is formally called *type I* (or *immediate*) hypersensitivity. Allergic reactions are distinctive because of excessive activation of certain white blood cells called mast cells and basophils by a type of antibody called Immunoglobulin E (IgE). This reaction results in an inflammatory response which can range from uncomfortable to dangerous(Hattevig*et al*.,1993).The two most commonly used methods of confirming allergen sensitization are skin testing and measurement of serum-specific IgE. Both methods have similar diagnostic value in terms of sensitivity and specificity, with both parameters varying with the clinical scenario and allergen tested(Linda Cox, 2011).Allergen specific IgE antibody measurement test is used to measures IgE antibodies in blood. Antibodies are part of the body's immune system. The antibodies measured in the test react to allergens.This test is used to determine the cause of an allergic reaction.

The IgE antibody molecule is composed of two identical heavy chains (Ɛ chains)and two identical light chains (κ or λ) linked by disulfide bridges. The molecule can be cleaved into $F_{ab}$ and $F_c$ fragments by proteolytic enzymes such as pepsin or papain.The $F_c$ region of the IgE (containing the carboxyl-terminal potion of both heavy chains) is constant for all IgE molecules. The $F_{ab}$ region (containing both of the lights chains and the other portion of the heavy chains) is variable and contains the antigen (allergen) specific portion of the antibody. Membrane receptors on certain white blood cells bind the $F_c$ portion of the IgE-allergen complex and trigger release of histamine and the appearance of the typical symptoms of allergic such as inflammation, itching, and congestion. Clinical manifestations of Type 1 (immediate hypersensitivity) diseases are caused by the release of pro-inflammatory mediators (such as histamine, leukotrienes and prostaglandins) from IgE-sensitized effector cells (mast cells and basophils) when cell-bound IgE antibodies interact with the allergen. Thus *in vitro* serum testing for IgE antibodies provides an indication of the immune response to the allergen(s) that may be associated with the disease.

## Materials and Methods

### Sample size

A total of 120 workers from granite stone cutting factory were studied regarding

collection ofBlood sample from the different age group of workers (21-30, 31-40, 41-50 and 51-60).From this, 60 persons taken as normal group and 60 persons taken as affected group.

**Clinical Method**

Estimation of Haemoglobulin by Sahli's method, Total Leucocytes Count (TLC),Total Erythrocyte Count, Absolute Eosinophil Count are estimated by Haemocytometer and Immunoglobulin by ELIZA method.

**Sample Collection**

Out of 140 male workers, a total of workers were agreed to collecting blood sample for analysis. 6ml of Blood sample was collected from each subjects by plastic metallic-free disposable syringe (DISPOVANcoroporation-Korea). Before sample collection the hands were cleaned with 70% ethanol. From this, 4 ml of blood was transferred into two vacutainer vials containing potassium ethylene diaminetetracetic acid "EDTA (K3)" as anticoagulant produced by AFMA-DISPO-Jordan (each containing 2ml of blood) for determination of blood lead level and complete blood count. The remaining 2ml of blood was transferred in plastic tube and was allowed to clot. Each vials was labelled with the subject identification code number and were kept at 4˚C until they were analysed. The haematological parameters like Hb, RBC, WBC, PCV, absolute eosinophil count, differential eosinophil count, lymphocyte, neutrophil and IgE were analysed in the Quality Diagnostic Lab, Vellore. The values of Hb, TLC and IgE were compared to normal reference lab values. Data were entered and analysed by SPSS 20. Differences were considered significantly different at a level of $P < 0.05$.

**Results and Discussion**

Generally, who entered this study, did not have enough information about the necessity of a ventilation system in the factory and also using personal protective devices. They used only non- standard surgical masks and some of them did not use any protective device.

**Table.1** Mean Value for the haematological parameters of normal workers

| Age Group | Hb (G%) | RBC ($10^6$ cells /cumm) | WBC (Cells /cumm) | PCV % | Neutro -phil % | Lympho -cytes % | Platelets $10^6$Cells / cumm |
|---|---|---|---|---|---|---|---|
| 21 – 30 | 12.00 | 4.8 | 9000.6 | 46.2 | 55.8 | 27.5 | 16.01 |
| 31 – 40 | 12.40 | 5.0 | 8533.1 | 43.8 | 58.7 | 30.5 | 20.08 |
| 41 -50 | 11.20 | 4.4 | 1040.56 | 50.0 | 60.1 | 32 | 18.98 |
| 51 – 60 | 10.20 | 5.0 | 9234.8 | 52.4 | 54.3 | 28 | 30.88 |

Table 1 shows Haematological parameters of normal workers

**Table.2** Mean values & P-Values of Differential Eosinophil Count, Absolute Eosinophil Count and Immunoglobin E for normal workers

| Age group | Differential Eosinophil (%) | P-Value | Absolute Eosinophil (Cells/cumm) | P-Value | IgE (IU/ ml) | P-Value |
|---|---|---|---|---|---|---|
| 21 – 30 | 2 | P>0.05 | 200 | P>0.05 | 280.05 | P>0.05 |
| 31 – 40 | 1.80 | P>0.05 | 250 | P>0.05 | 300.80 | P>0.05 |
| 41 – 50 | 2.30 | P>0.05 | 280 | P>0.05 | 189.40 | P>0.05 |
| 51 – 60 | 2.80 | P>0.05 | 300 | P>0.05 | 340.29 | P>0.05 |

P>0.05 was taken as insignificant in the above table.
Table 2 shows insignificant groups in control.

**Table.3** Mean Values for the haematological parameters of granite cutting workers

| Age Group | Hb (G%) | RBC ($10^6$ cells /cumm) | WBC (Cells /cumm) | PCV % | Neutro -phil % | Lympho -cytes % | Platelets $10^6$Cells / cumm |
|---|---|---|---|---|---|---|---|
| 21 – 30 | 12.56 | 3.9 | 8775 | 39.1 | 48.6 | 39.2 | 3.01 |
| 31 – 40 | 12.50 | 3.7 | 8521.8 | 38.1 | 50.7 | 38.5 | 3.07 |
| 41 -50 | 12.06 | 3.9 | 8587.5 | 37.7 | 53.1 | 37 | 2.97 |
| 51 – 60 | 10.33 | 3.3 | 8337.5 | 34.3 | 55.1 | 37 | 2.88 |

Table 3 shows Haematological parameters of exposed age group 51-60 has higher range of mean values compared with the age group of 21-30 although it is insignificant.

**Table.4** Mean values & P-Values for Differential Eosinophil Count, Absolute Eosinophil Count and Immunoglobin Eof granite cutting workers

| Age group | Differential Eosinophil (%) | P-Value | Absolute Eosinophil (Cells/cumm) | P-Value | IgE (IU/ ml) | P-Value |
|---|---|---|---|---|---|---|
| 21 – 30 | 10.6 | P<0.05 | 511.5 | P>0.05 | 659.05 | P>0.05 |
| 31 – 40 | 9.3 | P>0.05 | 854.8 | P<0.05 | 696.80 | P<0.05 |
| 41 – 50 | 8.5 | P<0.05 | 807.5 | P<0.05 | 658.12 | P<0.05 |
| 51 – 60 | 7.7 | P<0.05 | 837.7 | P<0.05 | 724.28 | P<0.05 |

P<0.05 was taken as significant in the above table.
Table 4 shows the Mean values & P-Values of Differential Eosinophil Count, Absolute Eosinophil count and Immunoglobin E with respect to different age groups 21-60.

The ventilation systems of these factories were not efficient at all and the average concentration of dust particles was high. Thus, there was not any statistically significant difference between test results of those who used and those who did not use personal protective devices. The normal and granite cutting workers ofMean Value of haematological parameters & P-Values of Differential Eosinophil Count, Absolute Eosinophil Count and Immunoglobulin E are presented in Table 1,2,3&4. According

to results, there were no significant differences in the mean values of granite cutting workers haematological parameters(Table 1)compared to haematological parameters of normal workers(Table 3).The mean values of IgE, differential eosinophil counts, absolute eosinophil counts were significantly increased in granite stone cutting workers(Table 2) age range 21-60, P-value of IgE is 1.74916, 2.41301,1.4442, age range 21-30& 41-60, P-value of Differential EosinophilCount is2.48698, 6.70087, 1.46184 and age range 31-60, P-value of Absolute EosinophilCount is 2.67925, 8.11762, 3.70961 compared to P-value ofDifferential EosinophilCount,Absolute EosinophilCount andIgEof granite cutting workers (Table 4).

Granite dust exposure promote the humoral immune system in some individuals. Results were compared in a mean and standard deviation values of hematological parameters. Considering the hazards of exposure to granite dust, this study incorporated the basic hematological parameters and the total leucocyte count. The idea was to identify a simple, readily available and cost effective screening test that could help in identifying the presence of disease, its severity in granite cutting workers potentially related to their workplace. Haematological parameter studied in the present work to confirm the involvement of granite dust in changing blood picture. High IgE counts represents the allergic reactions leads to damaging an area of the lungs called air sac (OleruUG 1984 and Aboutaleb 1995). Victims of silicosis are known to be susceptible to tuberculosis. In this present study,IgE and absolute eosinophil count and differential eosinophil count was to be significantly higher in granite dust exposed workers compared to normal workers.

In conclusion, in this present study we recommended that industries pertaining to granite cutting and polishing workers should regularly use appropriate personal protective equipments at their work site namely apparel, mask goggles and should get periodic medical surveillance including haematological profile. These measures would help to decrease the effects of granite dust. The diagnosis of granite dust is accomplished by obtaining complete occupational history, chest x-rays and lung function testing. Granite dust exposed individuals must have chest x-rays at least every 3-5 years. This disease might progress even after exposure has stopped. So, it is extremely important to prevent excessive exposure to granite dust (New jersy state department of health).

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