

Effects of Quarry Dust on Some Haematological Parameters among Workers at Okposi Umuoghara, Ebonyi State - Nigeria

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Abstract

Background: Unregulated mining has the potential to release harmful substances into the soil, air, and water and this may be associated with negative health, social and environmental impacts. Inhalable dust is produced during processing, grading and during the transit by the vehicles. Epidemiologic data indicate that there are occupational hazards associated with stone crushing and inhalation of stone dust. Quarrying/stone crushing is increasingly becoming the main stay of Ebonyi State economy and major source of internally generated revenue yet there is little or no government policy on regulation and occupational safety. Aim: This study examined the effect of long time exposure to quarry dust on the Full Blood Count (FBC) of quarry workers at Okposi Umuoghara, Ezza LGA of Ebonyi State – Nigeria. Methods: Cross-sectional, descriptive and analytical study was carried out on 100 quarry workers; 36 males and 54 females (age; between 18-57 years) who were exposed to stone dust for more than one year and 84 age/sex matched workers not exposed to quarry dust as control. The haemoglobin concentration, haematocrit, total white blood cell and differential counts were estimated using standard methods. Results: Majority of the quarry workers in Okposi - Umuoghara Industrial Estate were female, low income and uneducated who are not aware of the health implications of their carrier. There were significant differences in mean values of in Hb, PCV, and total WBC, relative neutrophils, lymphocytes and eosinophil counts compared with control. The differential lymphocytes and eosinophil increased significantly ($p > 0.05$), while the Hb, PCV, total WBC and relative neutrophil count decreased significantly ($P < 0.05$). No significant variation in differential monocyte count was observed. Conclusion: The alterations in level of some haematological parameters in exposed workers is an indication of effect of quarry dust on pathophysiology of blood and reticuloendothelia system of factory workers and in general human health. There is need for regular health evaluation of workers and education on the essential safety precautions through the use of personal protective equipment and more mechanized and safer means of stone processing.

Keywords: Occupational exposure, Quarry dusts, Haematological parameters, safety.

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INTRODUCTION

The health and social impacts of working in stone quarrying and related mining industries have been well documented. Inhalable dust is produced during processing, grading and during the transit by the vehicles. Epidemiologic data indicate that there are occupational hazards associated with stone crushing and inhalation of stone dust [1-3]. A particular concern in some quarries is the inhalation of dust containing silica which can lead to silicosis [4-5]. Studies indicate that workers exposed to quarry dusts have increased risk of developing lung cancer, pulmonary tuberculosis and airway diseases [6-7]. Respiratory problems and

occupational lung diseases are the major health hazards in dust-exposed workers and major cause of morbidity and mortality all over the world [8-11].

The progress of stone quarry industry in Abakaliki – Nigeria has increased from manual to semi-automated method year to year, largely owned by private business men with little or no government assistance. Apart from agriculture it is the major drive of the economy through the internally generated revenue. In the workplaces in developing countries health hazard and safety issues get less attention and such laborers are often exposed to dust without being aware of its threat to their health. There is need

therefore for initiatives to reduce risk and maximize benefits for occupational health and environmental safety.

To reduce the occupational risks associated with stone crushing, the workers should be educated on safety through the use of personal protective equipment (PPE), air purifying respirator (non power type)s and use a wet method on mining activities. Proper regulation and monitoring should be instituted to evaluate the health and safety of workers. Medical evaluation of the workers should be regularly and routinely done for timely and early detection of health related issues. This may be achieved by routine clinical and laboratory assessments like the full blood count [12]. These measures are however not well articulated in developing countries and indeed Nigeria.

Full blood count (FBC) which measures several components and features of blood is used to evaluate overall health and detect wide range of disorders, including anemia, infection and malignancies. Abnormal increases or decreases in cell counts as revealed in a full blood count may indicate an underlying medical condition that calls for further evaluation. Previous studies indicate that FBC have clinical utility in diagnosis and as biomarker associated with severity of diseases [12, 13-15]. This study therefore examined the full blood count (haemoglobin concentration, total white blood cell count and differential) among quarry workers exposed to quarry dust at Okposi Umughara industrial Layout, Ebonyi State Nigeria. This could possibly serve as evidence-based study that may be useful in health, environment and safety policy formulation towards occupation safety and environmental protection.

METHODS

Subjects and Sampling

This cross-sectional, descriptive and analytical study was conducted at Quarry Industrial layout, Okposi Umuoghara, Ezza North LGA of Ebonyi State – Nigeria. Only workers involved in crushing, clearing and loading of quarry products and constantly exposed to quarry dust were sampled for full blood count (haemoglobin concentration, haematocrit, total white blood cell and differential counts). Written informed consent was obtained from each participant and study protocol was approved by Ebonyi State University Ethical Review Committee. Strict anonymity was observed throughout the study and intervention

programmed aimed at educating the quarry workers on the safety and health implications of their work instituted. Sample size was calculated using the method of Cochran [16].

A total of 184 individuals comprised of 100 quarry workers (male, 36; female 64) between 18 -57 years and 84 age/sex-matched manual workers not exposed to quarry dust as control population were sampled between September to December 2019. Quarry workers with less than one year experience were excluded. Three milliliters of blood was collected from each participant into EDTA bottle for the assay and done without storage.

Measurements of Variables

The Hb, PCV, total WBC and differentials were done without preservation using standard methods. Data were analyzed using Pearson correlation and Student T-test, adapted from Statistical Package for Social Sciences (SPSS) version 22 and Microsoft excel software. Statistical significance was set at $p < 0.05$. Volunteer's age, contact details and analysis were stored in a password protected computer. During processing and analysis all samples were recognized by the laboratory number without any detail of the volunteer, each volunteers result were communicated to him/her only.

RESULT

There are 68 stone crushing plants at Quarry Industrial Layout Okposi Umuoghara, Ebonyi State – Nigeria. About 1250 workers are daily engaged in plants stone processing and transportation. The machines are mainly operated by men while the majority of females are engaged in grading and sorting of products. All the workers work for 9hours daily between 8am and 5pm except on Sundays.

The mean (\pm SD) values of haematological parameters (PCV, Hb, TWBC and WBC differentials) of quarry workers exposed to quarry dust and compared with control are presented in Table-1. There were significant differences in mean values of in Hb, PCV, and total WBC, relative neutrophils, lymphocytes and eosinophil counts compared with control. The differential lymphocytes and eosinophil increased significantly ($p > 0.05$), while the Hb, PCV, total WBC and relative neutrophil count decreased significantly. No significant variation in differential monocyte count was observed.

Table-1: Comparison of Mean values (\pm SD) of Hb, PCV, total WBC and WBC differentials of quarry workers and control

Variables	QW (n=100)	Controls (n=84)	T- value	p-value ^a
PCV (%)	40.52 \pm 2.43	43.70 \pm 2.25	-6.632	0.000
Hb (g/dL)	13.20 \pm 0.76	14.85 \pm 0.88	-10.269	0.000
Total WBC($\times 10^9$ /L)	4.50 \pm 0.86	6.00 \pm 1.09	-7.260	0.000
Neutrophil (%)	46.56 \pm 10.24	65.06 \pm 9.85	-9.205	0.000
Lymphocytes (%)	50.18 \pm 8.17	34.04 \pm 10.03	8.820	0.000
Monocytes (%)	0.68 \pm 1.186	0.62 \pm 0.88	0.288	0.774
Eosinophils (%)	2.38 \pm 3.85	0.62 \pm 0.90	3.149	0.003

Key: QW – Quarry workers, Hb – Haemoglobin, PCV – Pack Cell Volume, WBC – White Blood Cell

DISCUSSION

Abakaliki, Ebonyi State Nigeria is endowed with abundant mineral resources which have contributed immensely to national wealth. With associated socio-economic benefits, mineral resources are important source of wealth for a nation but before they are harnessed, they have to pass through the stages of exploration, mining and processing [17, 18]. In line of processing, stone dust are inhaled by workers leading to health and social impacts to workers and environment. Occupational exposure to quarry dust and health implications in Nigeria have been documented [19-21] with paucity of information as it effects on haematological parameters.

Full blood count is a nonspecific test that indirectly measures which measures several components and features of blood and used to evaluate overall health and detect wide range of disorders, including anemia, infection and malignancies. Clinical utilities have been documented in chronic and acute inflammation due to trauma, injury and infection as well as in autoimmune diseases, allergy and cancers [22-24].

In the present study, the Hb and PCV decreased significantly when compared with control. This indicates anaemia which may be due to intrinsic or extrinsic factors. This is in parity with the findings of Emmanuel *et al.*, [21] in cement factory in the same environment. The works of other researchers support these findings [25, 26]. The higher incidence of respiratory infections [27] and aggravated inflammatory responses observed in quarry workers may be attributable to the presence of higher level of respiratory system irritants in the quarry sites. This could possibly effect early-induce non-adaptive responses that may suppress the bone marrow or interfere with the haemopoietic process.

The reason for the significant decrease in total WBC count found in this study could not be explained. It differs from the work of Emmanuel *et al.*, in similar exposure in same environment. Though the relative lymphocyte and eosinophils were high, this could not possibly relate to decrease in total WBC especially as there was significant increase in neutrophils. Eosinophilia observed in this study is expected mindful

of irritation and allergic responses caused by the inhalation of quarry dust. Raised level of eosinophils has been associated with allergic responses [28] and significantly higher number of eosinophils has been reported in patients positive for nerve growth factor which plays an important role in allergies and respiratory diseases [29].

Significant increase in lymphocyte count was observed in this study similar to other finding [25, 30]. Altered immune responses in workers exposed to quarry dusts may contribute to the relative lymphocytosis.

It has been suggested that long duration of exposure to quarry dust might bring out significant haematological changes [31, 32] since various occupational exposures cause lung injury and initiate a chronic inflammatory process that may progress to initiate fibrosis. Alternatively, chronic exposure to irritating material might lead to adaptation process, which resists inflammation and leukocytosis. It has been suggested that adaptation process possibly may be responsible for the non significant rise in total WBC count with regard to the period of exposure [33].

CONCLUSION

In conclusion therefore, the alteration in level of haematological parameters in exposed workers is an indication of effect of quarry dust on pathophysiology of blood and reticuloendothelia system of factory workers and in general human health. There is need for regular health evaluation of workers and education on the essential safety precautions through the use of personal protective equipment and more mechanized and safer means of stone processing.

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