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Prevalence of latent eosinophilia among occupational gardeners at Babcock University, Nigeria

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ABSTRACT

Objective: To determine the level of eosinophils present in the blood and sputum samples, presumably as a result of continual occupational exposure to allergens while on duty, as gardeners at Babcock University, Nigeria.

Methods: Haemocytometer and Olympus microscope were utilized to estimate eosinophils population in 44 blood samples and 21 sputum samples respectively.

Results: Relationship between the occurrence of eosinophil in blood and the exposure period among Babcock University gardeners had a positive correlation (r = + 0.08, t = 4.55, P < 0.05). It was found that blood eosinophil count in these workers correlated with the length of exposure period.

Conclusions: The nature and the gardening activities are not a risk factor that significantly affect eosinophil level but duration of exposure to allergens. However, all safety precautionary kits and wears should be enforced and embraced by the concerned occupational gardeners so as to avert and subvert its pre-disposing deleterious effect on them.

1. Introduction

Allergic reactions are distinctive because of excessive activation of certain white blood cells called basophils and mast cells by a type of antibody called immunoglobulin E (IgE) [1,2]. This reaction results in an inflammatory response ranging from mild to severe cases [2]. Allergies can play a major role in conditions such as asthma. In some individuals, severe allergies from environmental, dietary or medication allergens may result in life-threatening reactions called anaphylaxis [3].

Food allergies and reactions to venom of many stinging insects such as wasps and bees are more often associated with these severe reactions [4,5].

The worst allergens are typically from weeds, grasses, and certain specific trees. Because some of these plants are wind-pollinated, they produce a lot of powdery, easily inhaled pollen that triggers allergic responses. Insect-pollinated plants, such as flowers and vegetables, have pollens that are large and sticky, which generally might not cause much problem compared to many other allergens such as dust, wool or pollen that are of tiny-sized airborne particles. In these cases, symptoms arise in areas in close contact with air, such as eyes, nose, and lungs [5–7]. For instance, allergic rhinitis, also known as hay fever, causes irritation of the nose, sneezing, itching, and redness of the eyes

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The study protocol was performed according to the Helsinki declaration and approved by Babcock and Kwara State Universities Ethical Review Boards. Informed written consent was obtained from subjects.

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[5,7]. Inhaled allergens can also lead to asthmatic symptoms, caused by narrowing of the airways (bronchoconstriction), shortness of breath (dyspnoea) and coughing [5]. Substances that come into contact with the skin, such as latex, are also common causes of allergic reactions, known as contact dermatitis or eczema [8,9]. Skin allergies frequently cause rashes, swelling and inflammation within the skin, in what is known as "wheal and flare" reaction [10]. Latex is another substance that can trigger an IgE-mediated cutaneous, respiratory, and systemic reaction. The prevalence of latex allergy in the general population is low, being less than one percent; while the sensitivity among healthcare workers is higher, ranging from seven to ten percent [5]. This has been attributed to the high level of exposure that health workers have to wear latex gloves while carrying out their duties.

Host factors for allergy include heredity, gender, race, and age. Heredity is by far the most significant, although other factors have not been exhaustively investigated. However, there have been recent increases in the incidence of allergic disorders that cannot be explained by genetic factors alone [10,11]. Four major noticeable environmental candidates are alterations in exposure to infectious diseases during early childhood, environmental pollution, allergen levels and dietary changes [5].

One of those occupations that bring about exposure to allergens produced by weeds, grasses and trees is gardening. Gardening is an age-old vocation that has been and is still the occupation of many individuals in developing countries. Not all plants produce allergens, but allergen-producing plants are found sandwiched among other allergen-free plants. Gardeners are frequently exposed to allergens during the process of weeding and trimming plants. Individual gardeners that are repeatedly exposed to these plants may develop allergy which is haematologically characterized as eosinophilia. It is imperative to mention that eosinophilia is not limited to allergic situations only but could also be triggered by the presence of parasites in humans. Recent research has shown that some common parasites, such as intestinal worms (*e.g.*, hookworms), secrete chemicals into the gut wall and, (hence, the bloodstream) that suppress the immune system and prevent the body from attacking the parasite [12]. Indeed, eosinophilic oesophagitis, common among black children, has been attributed to the effect of allergens [12]. Improved hygienic practices, access to education and constant deworming of school children has now led to a low level of parasitic infestation among many individuals in Nigeria [13]. Thus, high levels of eosinophilia in individuals, particularly people exposed to occupational allergens, may correctly be linked to allergic reactions. In this study, quantitative determination of the level of eosinophils present in the blood and sputum samples of Babcock University gardeners, presumably as a result of occupational exposure to allergens while on duty was carried out.

2. Materials and methods

The study was carried out among gardeners of Babcock University, Ilishan-Remo, Ogun State, Nigeria. Forty four (44) blood samples and 21 sputum samples were collected from the gardeners. Thirteen (13) blood and sputum samples were collected from Babcock University non-gardening staff as reference control.

Inclusion criteria included gardeners who engage in mowing of lawn, flower trimming, weeding, nursing, raking/parking and sweeping, all of whom were males and fall within the age range of 20–59 years. Exclusion criteria included non-gardener University staff and students below the age of 20 years. Gardeners who are already known to be asthma patients and persons with Cushing's syndrome are also excluded.

Subject's consent was verbally sought and obtained with a consent form, before sample collection. Babcock University ethical approval committee gave approval to proceed on the project. Demographic data of the subjects were obtained through a questionnaire and samples were collected from Babcock University gardeners. Sputum and blood samples were obtained from subjects. The sputum samples were meant to complement the blood samples. Blood and sputum sample collection took two weeks. Thirteen subjects served as control samples. These were non-gardener workers of other units in Babcock University who belong to the same age range as the subjects under study.

Four millilitres of venous blood sample was collected from each subject using a sterile disposable needle and syringe and dispensed into an ethylene diamine tetra acetic acid anticoagulated bottle. Samples collected were analysed for total eosinophil count within 6 h. Similarly, sputum samples were collected in a sterile universal bottle and analysed within 6 h.

2.1. Estimation of total eosinophil count using 1% aqueous eosin Y

Whole blood was diluted appropriately using a diluent which consisted of 1% aqueous eosin Y (5 mL), acetone (5 mL), distilled water (90 mL). This diluent lyses the red cells and stains the granules in the eosinophil, but does not stain the other leucocytes. The eosinophils were identified in the Neubauer counting chamber by their bright red stained granules [14].

2.2. Sputum eosinophil count using Giemsa stain

Sputum was stained using Giemsa solution which consisted of eosin-methylene blue (which stains the nuclei blue and cytoplasm pinkish red). Methylene blue chloride and azure 2 eosinate improves the intensity of nuclear staining and capability to resolve selective cellular structures [15].

2.3. Blood eosinophil count

A total volume of 20 μL of blood was added to 380 μL of diluting fluid in a test tube. It was mixed properly and allowed to stand at room temperature for 5 min to allow lysing of red cells. An improved Neubauer counting chamber was assembled and charged with the mixture of blood and diluent. The cells were allowed to settle in the moist chamber for 3 min. Numbers of eosinophils in the four large corner squares of the counting chamber were counted using 40× objective lens. Eosinophils were identified by their bright red stained granules.

The calculation is as following: Total eosinophil count/mm^3 = Number of eosinophil counted × 1/Area counted (mm^2) × 1/Depth (mm) × Dilution = Number of eosinophil counted × 1/4 × 1/0.1 × 20 = Number of eosinophil counted × 50/mm^3. The normal range is 50–450/mm^3 for adults [15].