RESEARCH ARTICLE

SENSITIZATION TO AEROALLERGENS IN ADULT PATIENTS WITH ALLERGIC RHINITIS AT KENYATTA NATIONAL HOSPITAL

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ABSTRACT

Background: Allergic rhinitis represents a global health problem. Sensitization is a risk factor for developing allergic rhinitis. There is a dearth of data on sensitization to aeroallergens in the developing countries particularly those in sub-Saharan Africa.

Objective: To determine the prevalence and pattern of sensitization to aeroallergens in patients with allergic rhinitis at Kenyatta National Hospital (KNH) Ear, Nose and Throat (ENT) outpatient clinic.

Design: A cross sectional study.

Methods: Adult patients on follow up for allergic rhinitis at the KNH ENT outpatient clinic were enrolled in the study in a consecutive manner. Allergy testing via skin prick testing was carried out as described in the Allergic Rhinitis Impact on Asthma (ARIA) guidelines. The indoor aeroallergens that were evaluated included house dust mite, mould, cockroach and cat dander for allergens. Grass pollen was tested for outdoor aeroallergens.

Results: Eighty one patients diagnosed with allergic rhinitis were enrolled in the study. Majority of the patients (96%) tested had sensitization to at least one of the tested allergens. House dust mite was the most prevalent allergen (77%) followed by moulds (57%) and cockroaches (43%). The prevalence of sensitization to cat dander and Bermuda grass was 40% and 30% respectively. Monosensitization was found in 12.3% of the patients.

Conclusion: Indoor allergens were more common than outdoor allergens. Skin prick testing should be encouraged in patients with allergic rhinitis due to the high prevalence of sensitization.

Key words: Allergic rhinitis, Asthma, Aeroallergens, Sensitization, Allergens, Skin prick test

INTRODUCTION

Allergic rhinitis is the most prevalent type of rhinitis. It is a heterogeneous disorder that significantly impairs the patient's quality of life, and its prevalence has markedly increased in recent decades[1,2]. Worldwide, the burden of allergic diseases has been increasing steadily particularly in the low and middle income nations. Moreover, the key manifestations of respiratory allergy, namely, allergic rhinitis and asthma, have been on the rise in the last two decades[3]. Globally, it is estimated that there are 400 million patients with allergic rhinitis and 334 million patients with asthma[3,4]. Asthma ranks among the top most specific diseases, with respect to years lost to disability adjusted life years[5]. It is associated with allergic rhinitis in 74% to 81% of the cases[6].

Allergic sensitization is defined as the production of immunoglobulin E (IgE) in response to allergens[1]. This represents a principal step in the pathogenesis of IgE-mediated allergic diseases. As a result, it is a key risk factor in development of allergic rhinitis and asthma[3,7,8].

There is paucity of published literature on sensitization to aeroallergens in patients with allergic rhinitis especially in sub-Saharan African countries such as Kenya. The lack of evidence is an impediment to the design and implementation of preventive measures. The present study was conducted to address this gap, at least partially, by investigating the prevalence of sensitization to selected aeroallergens among adult patients with allergic rhinitis seeking treatment at the Kenyatta National Hospital (KNH) Ear, Nose and Throat (ENT) outpatient clinic.

MATERIALS AND METHODS

This was a hospital-based cross sectional study done between March and September 2018. The study population comprised of adult patients (≥18 years) who were on follow up for allergic rhinitis at the KNH ENT out-patient clinic. Ethical approval to conduct the study was obtained from KNH and University of Nairobi Ethics Review Committee. Written informed consent was sought from all the study participants. In this study, clinical diagnosis of allergic rhinitis was done as per the Allergic Rhinitis Impact on Asthma (ARIA) 2010 guidelines which defines allergic rhinitis as watery rhinorrhoea with one or more of the following symptoms; nasal blockage, sneezing and nasal itching[9]. Exclusion criteria included patients who were pregnant, those who had diffuse dermatological conditions, those on drugs that interfere with the skin prick test, those with response persistent severe or unstable asthma and non-consenting patients. Data was collected using an interviewer-administered questionnaire. Skin prick tests were performed by the principal investigator as described by the European Academy of Allergy and Clinical Immunology[10]. Five standardized allergen extracts acquired from Diagenics Limited (Milton Keynes, United Kingdom):

(i) Mould: Allergen extract for mould was a mould mix which contains; *Aspergillus fumigatus, Mucor mucedo, Penicillium notatum, Pullularia pullulans, Rhizopus nigricans* and *Serpula lacrymans.*
(ii) Cockroach: The common cockroach in our setup is the German cockroach, allergen tested was *Bla g 2*. House dust mite: *D. pteronyssinus*.
(iii) Grass pollen: Commonest grass species in our setup is the Bermuda grass and the one we tested, *Cyn d 1* being the commonest allergen.
(iv) Cat dander: Allergen that was used is *Fel d 1*, has been shown to be the commonest allergen.

The positive control was 9% histamine hydrochloride and the negative control was normal saline 0.9% solution. The volar aspect of the forearm was cleaned with alcohol and then a drop of each of the test solutions was applied on the skin. A skin-prick test was done within the drop using a lancet. The results of the tests were read after 15 minutes. The mean wheal diameter was measured using a ruler and recorded in millimetres (mm). A positive test was taken to be any wheal diameter that was 3 mm or greater than the negative control. A patient who exhibited a positive reaction to at least one of the five aeroallergens was considered to have an allergen sensitization.

Data entry and statistical analyses was conducted using IBM SPSS v. 20. Descriptive analysis involved calculating mean and standard deviations (SD) for normally distributed continuous variables. Continuous data with skewed distributions were described using medians and interquartile ranges. Categorical data were described using absolute numbers and proportions. A cut off value of $p<0.05$ was set as the threshold for statistical significance during hypothesis testing.

RESULTS

A total of 81 patients aged 18 years and above presenting to KNH with allergic rhinitis were recruited in the study. The mean age of the patients was 36.7 years (SD 8.9) with an age range from 18 to 57 years. The most common age group was 30-39 years accounting for 33 (40.7%) of the patients. There were 49 (60.5%) female patients and 32 (39.5%) male patients, giving a male-to-female ratio of 2:3. Out of the 81 allergic rhinitis patients in the study 41 (50.6%) were persistent, moderate-severe cases (Table 1). There were 33 (40.7%) cases with comorbid conditions, namely asthma 27 (33.3%) and eczema 10 (12.3%). Four (4.9%) cases had both comorbidities (Table 2).

Table 1: Severity of allergic rhinitis diagnosis in adults in KNH

	Frequency (n=81)	(%)
Severity of allergic rhinitis diagnosis		
Intermittent, mild allergic rhinitis	20	24.7
Persistent, mild allergic rhinitis	1	1.2
Intermittent, moderate-severe allergic rhinitis	19	23.5
Persistent, moderate-severe allergic rhinitis	41	50.6

There were 75 (92.6%) patients who were positive for at least one of the five aeroallergens. The rest (6; 7.4%) showed no sensitization to the test aeroallergens. Monosensitization occurred in 10 (12.3%) of the patients with allergic rhinitis. The specific aeroallergens to which these 10 patients were sensitive to were: house dust mite (n = 5), moulds (n = 2), cockroach (n = 1) and cat dander (n = 2). Polysensitization occurred in 65 (80. 3%) (Figure 1).

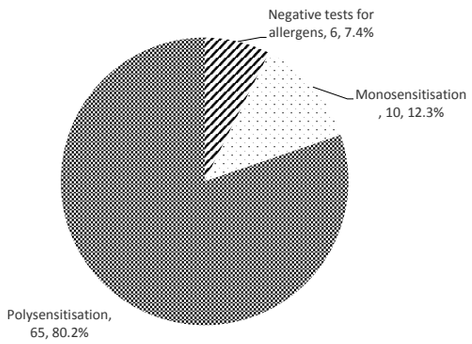


Figure 1: Sensitization for aeroallergens in adult patients with allergic rhinitis

Table 2 shows the distribution of the patients by the number of aeroallergens they had sensitization to. Patients who were sensitive to two, three, four aeroallergens were 24 (29.6%), 27(33.3%) and 10 (12.4%) respectively. Four patients were sensitive to all the five allergens.

Table 2: Sensitization according to number of aeroallergens

No. of aeroallergens	No. positive (n=81)	(%)
0	6	7.4
1	10	12.4
2	24	29.6
3	27	33.3
4	10	12.4
5	4	4.9

Disease severity did not have an impact on sensitization pattern. For all the four disease severity most patients had polysensitization (Table 3).

Table 3: Association between number of positive allergens per patient and disease severity

	Negative	Mono-sensitization	Poly-sensitization	P-value
Rhinitis severity				
Intermittent, mild allergic rhinitis	0(0.0)	2(10.0)	18(90.0)	0.301
Persistent, mild allergic rhinitis	0(0.0)	0(0.0)	1(100.0)	0.883
Intermittent, moderate-severe allergic rhinitis	3(15.8)	3(15.8)	13(68.4)	0.220
Persistent, moderate-severe allergic rhinitis	3(7.3)	5(12.2)	33(80.5)	0.998

The pattern of sensitization did not differ for disease comorbidities, for both comorbidities most patients with and without the condition had polysensitization (Table 4).

Table 4: Association between number of positive allergens per patient and comorbidities

Condition	Negative	Mono-sensitization	Poly-sensitization	P-value
Asthma				
Yes	2(7.4)	3(11.1)	22(81.5)	0.972
No	4(7.4)	7(13.0)	43(79.6)	0.972
Eczema				
Yes	1(10.0)	1(10.0)	8(80.0)	0.926
No	5(7.0)	9(12.7)	57(80.3)	0.926

Pattern of sensitization to aeroallergens in patients with allergic rhinitis are presented in Figure 2.

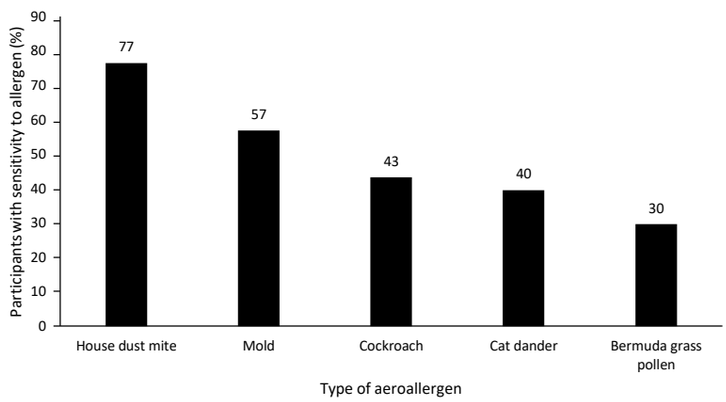


Figure 2: Pattern of sensitization to aeroallergens in allergic rhinitis according to types of aeroallergens

There was no evidence of a statistically significant association between positive test findings for sensitivity to house dust mites, mould, cat dander or Bermuda grass pollen and patient factors including age and sex. However there was a significant association between positive results in sensitivity test for cockroach aeroallergen and patient gender, p = 0.009. The odds of sensitivity to cockroach aeroallergen in females was 73% higher than that in males with positivity of 55.1% versus 25% in females and males respectively.

There was no statistically significant association between the two conditions (asthma and eczema) and house dust mite, mould, cockroach or cat dander sensitivity. Bermuda grass pollen sensitivity however showed a statistically significant association, p = 0.034. Sensitivity to pollen among patients with eczema was 60% compared to 25.4% among those without eczema.

DISCUSSION

Sensitization to aeroallergens in patients with allergic rhinitis plays a major role in the pathogenesis of disease. Sensitization to at least one aeroallergen was found to be at 92.6%. The prevalence was higher than what was found by Lee *et al*[11] at 70.1%, because the study included a wider age group of allergic rhinitis patients with an age range of 3 to 70 years with noted prevalence of sensitization decreasing with age. Prevalence of sensitization was also noted to be lower in non-hospital based studies like that of Ngahane *et al*[12] in Cameroon who conducted the study in college students and found sensitization to be at 42.8%.

The commonest allergen was found to be house dust mites at 77%. Several studies done in various parts of the world have shown house dust mites to be the commonest allergen in allergic rhinitis patients. Farrokhi *et al*[13] in Iran found the prevalence of sensitization to house dust mites to be 88.5%. A study done in Cameroon by Ngahane *et al*[12] found house dust mites to be the commonest aeroallergen participants were sensitized to. Mould was the second commonest allergen with a prevalence rate of 53%, followed by cockroach at 43% prevalence in this study. Some studies done showed that cockroach sensitization was the second commonest allergen. Lâm *et al*[14] in North Vietnam and Ngahane *et al*[12] in Cameroon all found that cockroach sensitization was the second commonest indoor allergen, mould sensitization was low. The Vietnam study was a population based study and the sensitization to cockroach was the same for both rural and urban areas while the Cameroon study was done in an urban setting.

Severity of disease or presence of comorbidities, asthma and eczema, had no significant association with prevalence of sensitization. We did however find it affected the pattern of sensitization, with a higher prevalence of sensitization to Bermuda grass in patients with eczema 60% and 25.4% in patients with eczema. There was no statistically significant association between age and the pattern and prevalence of sensitization in this study. Ngahane et al[12] also found that the pattern of sensitization was the same for different ages, though he had a younger population of college students. Christoff *et al*[15] analyzed a wider range in age (3 years to over 44 years) in their participants and found no association with sensitization. Sex was also not a significant factor in prevalence of sensitization. In this study however we found a cockroach allergy was more common in women than men, with positivity being 55.1% in women and 25% in men. The difference between the cockroach sensitization in females could be due to the gender roles in our communities. Women tend to be the ones who do more of the chores at home, including more time spent in the kitchen where the cockroaches are found in the homes. This would lead to higher exposure in the women than the men hence the higher sensitization in the women than men.

Monosensitization was at 12.3% with house dust mite being the most common allergen, which is comparable to the study by Ngahane *et al*[12] in Cameroon who found monosenstization at 13.2% but for them cockroach was the commonest allergen. No monosenstization to Bermuda grass was found. Polysensitization has been found to be more common in patients with allergy, this study had a rate of 80.3% with 33.3% having sensitization to two allergens and 4.9% to all five allergens tested.

In conclusion, the current study showed a high prevalence of sensitization to aeroallergens in patients with allergic rhinitis with house dust mite being the commonest allergen. Polysensitization was more prevalent than monosensitization. We recommend skin prick tests be incorporated as part of the management of allergic rhinitis patients at the clinic as allergen avoidance is important in management of the disease.

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