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Serum allergen-specific IGE to common aeroallergens among allergic rhinitis patients in Egypt



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Abstract

Background: Allergic rhinitis is the most prevalent allergic disease, and the prevalence and sensitization patterns differ among countries. Identifying the most common inhalant allergen in each region plays a key role in the diagnosis and management of allergic rhinitis. There are no data available about the most prevalent aeroallergen among allergic rhinitis patients in Egypt. The aim of this study is to evaluate the prevalence of positive serum allergen-specific IGE to common inhalant allergens among allergic rhinitis patients in Egypt. A cross-sectional study was conducted on 354 allergic rhinitis patients, serum allergen-specific IGE was measured by using the Immuno CAP system to 16 common regional aeroallergens including (pollens, mite, molds, animal dander, and cockroach).

Results: The overall rate of sensitization to any allergen was 74.6%. *Dermatophagoides pteronyssinus*, birch pollens, and *Dermatophagoides farinae* were the most prevalent allergens (29.7%, 23.7%, and 18.6%), respectively. *Cladosporium* molds were the least prevalent individual allergens (1.7%).

Conclusion: Our data suggest that *Dermatophagoides pteronyssinus* and birch pollens were the predominant allergen sources among allergic rhinitis patient in Egypt.

Keywords: Aeroallergen, Allergic rhinitis, Serum allergen-specific IGE

Background

Allergic rhinitis (AR) is induced by a reaction mediated by immunoglobulin E in allergen sensitized patient and is characterized by recurrent sneezing, runny nose, nasal congestion, and itchy nose, which most often associated with ocular itching, redness, and/or lacrimation in 60–70% of cases [1].

The prevalence of AR was reported between 10 and 30% of adults and 40% of children [2].

The most common cause of AR is hypersensitivity to inhalant allergens. The type and quantity of inhalant allergens vary depending on the geographical variation, seasonal and climatic changes, and location [3]. Identification of the most common inhalant allergen in each

region contributes to the diagnosis and management of allergic rhinitis. Numerous studies have shown that the distribution and type of inhalant allergens vary varies between countries and from region to region [4].

The results of serum allergen-specific IgE are closely related to the results of skin prick tests and nasal challenge test. Allergen-specific IgE tests are very specific and sensitive. One of their benefits is that medication and skin lesions do not affect the results [5].

Although the prevalence of AR is very high in Egypt, no data are available on the most common aeroallergens, so this study aims to assess the prevalence of positive serum-specific IgE to various common aeroallergens among patients with allergic rhinitis in Egypt, to develop an effective strategy for the prevention and management of allergic rhinitis. The aim of this study was to evaluate the prevalence of positive serum-specific IGE to common inhalant allergens among allergic rhinitis patients in Egypt.

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Methods

Study population and design

A cross-sectional study was performed on 354 patients with symptoms of allergic rhinitis, who were referred to outpatient clinic of Allergy and Clinical Immunology, between January and December 2019, in accordance with the ethical standards of faculty of medicine ethical committee.

Included criteria were (1) diagnosis of allergic rhinitis as defined by a complaint of any combination of the following symptoms: itchy nose, sneezing, runny, or blocked nose without a cold or flu in over the past 12 months.

(2) Patients with moderate to severe allergic rhinitis.

(3) Non-allergic rhinitis patients and smoker were excluded from this study.

(3) Negative history of specific immunotherapy.

Patient demographics were obtained from history.

Specific IGE

The serum allergen sIgE for 16 common aeroallergen (dermatophagoides 3arina, dermatophagoides pteronyssinus, alternaria 3arina3te, Aspergillus niger, aspergillus fumigatus, candida albicans, cladosporim herbarum, penicillium notatum, mix grasses pollens, birch, ragweed, cat, dog, feather mixture, cockroach, and horse epithelium) was measured in all patients by using the ImmunoCAP system according to the manufacturer's instruction (Pharmacia, Uppsala, Sweden).

The CAP classification system divides results into seven categories from 0 to 6. Additional classes are scored as follows: < 0.35 kU/L class 0; 0.35–0.70 kU/L, class 1; 0.71–3.50 kU/L class 2; 3.51–7.50 kU/L, class 3; 7.60–17.50 kU/L class 4; 17.60–50.00 kU/L class 5; > 50 kU/L class 6. The units reported by CAP are in accordance with the defined WHO serum standard IRP 75/520. For the present analyses, patients were classified as sensitive to the allergens if the serum IgE level was \geq 0.35 kU/L.

Statistical analysis

Data were gathered, revised, coded, and entered into version 23 of the Statistical Package for Social Sciences (IBM SPSS). IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. The quantitative data with parametric distribution while with non-parametric were presented as median with inter-range (IQR) quartile. Qualitative variables were also displayed as numbers and percentages.

Results

Three hundred and fifty-four patients were evaluated for serum-specific IGE against 16 aeroallergens. There were 207 (58.5%) females and 147 (41.5%) males evaluated for

serum-specific IGE against common aeroallergens. The mean (\pm SD) age of the patients was 34.82 ± 16.63 with range from 10 to 85. Concomitant asthma was found in 24.6%, and allergic conjunctivitis in 13.6%. Demographic and clinical characterization of the patients is presented in (Table 1).

Overall rating of sensitization to any allergen was observed in 74.6% of the patients, with 25.4% of the patients showed negative serum-specific IGE to any of the tested allergens.

Moreover, Dermatophagoides pteronyssinus, birch tree, Dermatophagoides 4arina, and Alternaria alternate were the most prevalent allergens (29.7%, 23.7%, 18.6%, 16.1%), respectively, among the patients with allergic rhinitis (Fig. 1). Among the study sample of patients, Dermatophagoides pteronyssinus was the most common allergen (29.7%), Dermatophagoides farina (18.7%), animal dander (cat hair 11% and dog epithelia 10.2%, horse epithelium 1.7%), feather mixture 3.4%, coacroach 6.8%. Among molds, Alternaria alternate was the most prevalent allergen 16.1%, followed by Aspergillus fumigatus 13.6%, Candida albicans 12.7%, Aspergillus niger 5.1%, Penicillium notatum 3.4%, and Cladosporium was the least prevalent mold allergen 1.7%). Among outdoor allergens, birch tree pollen (23.7%) made the most prevalent allergen followed by mix grasses pollen (13.6%), sun flower seed 9.3%) (Table 2). The results have shown that 74.6% of the patients were poly-sensitized to two or more allergens, 8.5% of the patients were sensitized to more than five allergens (Fig. 2).

Discussion

Several studies have been conducted to evaluate effectiveness of specific IgE tests in the diagnosis of allergy. Results that have been reported from multi-center studies showed sensitivity in a range of 84 to 95% and specificity ranging from 85 to 94% [6].

Diagnosis of allergic rhinitis is based on a synergy between allergic symptoms and diagnostic tests. In vitro

Table 1 Demographic and clinical characterization of the patients

		Total no. = 354
Sex	Males	147 (41.5%)
	Females	207 (58.5%)
Age	Mean \pm SD	34.82 \pm 16.63
	Range	10–85
Associated allergic conjunctivitis	No	306 (86.4%)
	Yes	48 (13.6%)
Associated bronchial asthma (BA)	No	267 (75.4%)
	Yes	87 (24.6%)

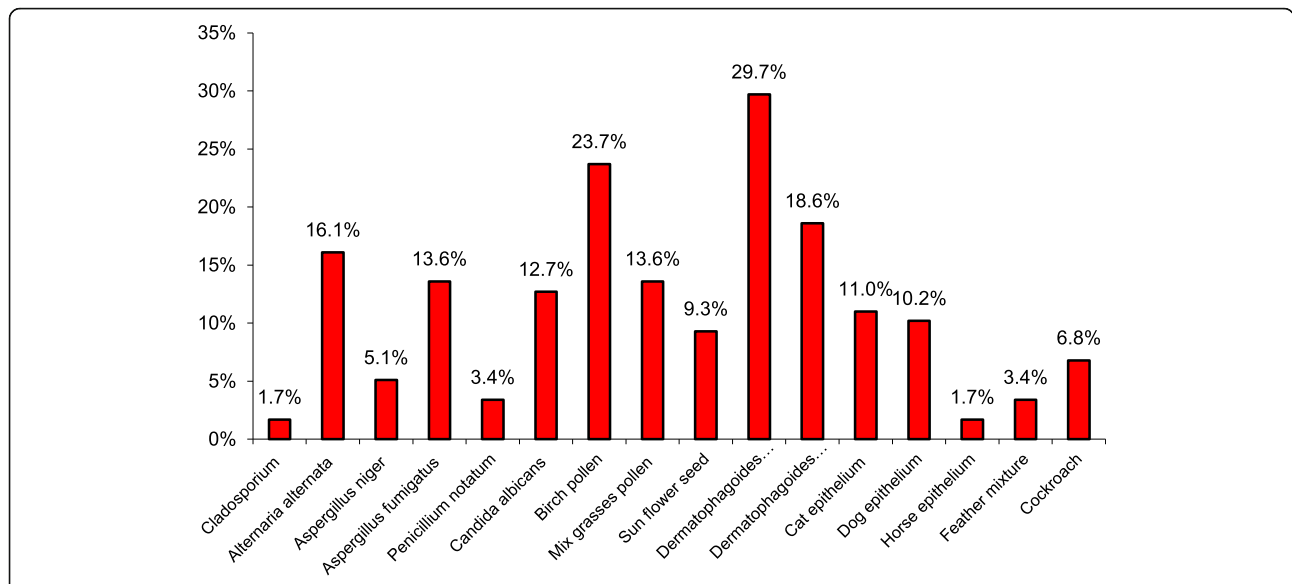


Fig. 1 Prevalence of positive-specific IGE to common aeroallergen among allergic rhinitis patients

analysis and in vivo methods used to detect IgE (cell-bound or free) [7].

Serum IgE is generally considered to be specific biomarker for the allergic reaction, as the allergic disorders are characterized by an inflammatory response mediated by IgE. Measuring of IGE is a popular method for diagnosing allergies [8].

The present study aimed to estimates of the prevalence of inhalant allergens to provide valuable

information to develop effective strategies for the prevention and treatment of allergic rhinitis. The author conducted an epidemiologic survey of AR and examined the sensitization rates against common aeroallergens by measuring the serum-specific IgE of 354 patients aged between 10 and 85 years in an Egyptian population between January and December 2019.

The findings of this study have revealed a high sensitization rate to any allergen (74.6%), which is almost

Table 2 Prevalence of positive-specific IGE to common aeroallergen among allergic rhinitis patients

	Median/mean ^a	Range	Negative	Positive
Cladosporium ^a	4.03 ± 0.74	3.5–4.55	348 (98.3%)	6 (1.7%)
Alternaria alternata	2.5 (1.3–15.8)	0.36–100	297 (83.9%)	57 (16.1%)
Aspergillus niger	1.1 (0.53–1.8)	0.35–3.9	336 (94.9%)	18 (5.1%)
Aspergillus fumigatus	0.58 (0.4–2.2)	0.35–12.6	306 (86.4%)	48 (13.6%)
Penicillium notatum	0.36 (0.35–0.65)	0.35–0.93	342 (96.6%)	12 (3.4%)
Candida albicans	0.61 (0.37–0.85)	0.35–39	309 (87.3%)	45 (12.7%)
Birch pollen	0.52 (0.36–2)	0.35–11.2	270 (76.3%)	84 (23.7%)
Mix grasses pollen	1.31 (0.56–6.05)	0.35–22.2	306 (86.4%)	48 (13.6%)
Sun flower seed	1 (0.37–3.8)	0.35–16.6	321 (90.7%)	33 (9.3%)
Mite p (<i>Dermatophagoides pteronyssinus</i>)	1.6 (0.59–5.8)	0.35–31	249 (70.3%)	105 (29.7%)
Mite f (<i>Dermatophagoides farinae</i>)	2.75 (0.53–6.7)	0.34–75	288 (81.4%)	66 (18.6%)
Cat epithelium	14.5 (7.2–100)	0.53–100	315 (89.0%)	39 (11.0%)
Dog epithelium	0.66 (0.37–1.35)	0.35–30	318 (89.8%)	36 (10.2%)
Horse epithelium	3.99 (0.5–7.47)	0.5–7.47	348 (98.3%)	6 (1.7%)
Feather mixture	1.45 (0.83–2.05)	0.35–2.5	342 (96.6%)	12 (3.4%)
Cockroach	2 (1.65–5.25)	0.66–5.8	330 (93.2%)	24 (6.8%)

All data were presented as median with IQR with numbers and percentages

^aData were presented as mean ± SD with number and percentages

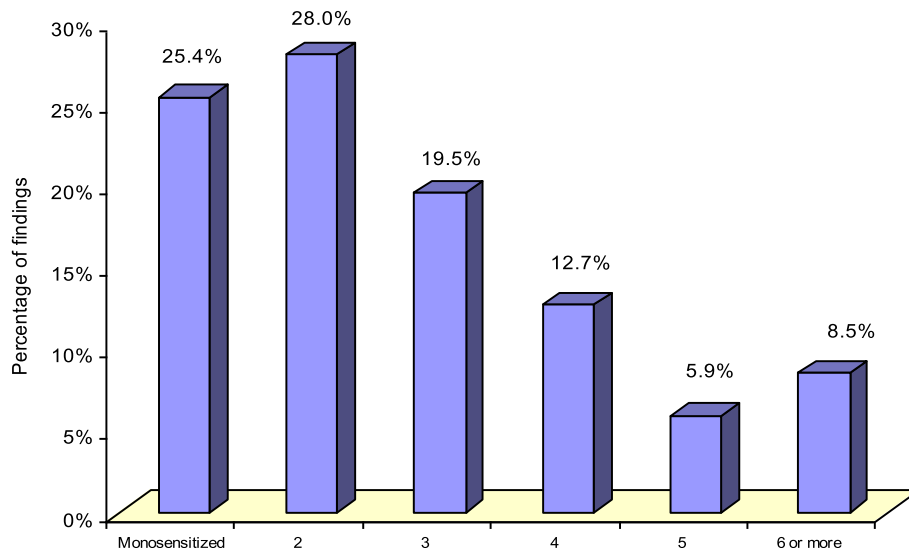


Fig. 2 Percentage of patients by number of positive serum-specific IGE to allergens

similar to the previous study in Japan [9]. The results have shown that 74.6% of the patients were polysensitized to two or more allergens. Multi-allergen sensitization was caused by numerous factors including, hereditary, environmental factors, and cross-sensitization between allergens sharing common allergenic epitopes.

House dust mite was the most common allergen with *Dermatophagoides pteronyssinus* (29.7%) followed by *Dermatophagoides farinae* (18.6%). Other studies in humid regions like Thailand [10] and in hot and dry regions like Kuwait [11] also showed a higher rate of sensitization to house dust mites. However, the climate of Egypt is dry and moderate. The possible reason of increased prevalence of mite's allergy could be increased use of air conditioners that make the environment favorable for mites. Another possible explanation could be increased humidity in coastal cities of Egypt that make them favorable for dust mite growth.

In our study, serum allergen-specific IGE in patients with allergic rhinitis reported a high incidence of pollen allergen and the most prevalent was found to be birch pollen, because birch pollen allergens induce large and complex patterns of IgE cross-reactivity [12]. These results are consistent with a local study conducted with skin prick test on 135 patients having AR in Egypt [13].

In this study, the rate of sensitization to cat allergen was 11% and sensitization rate to dog allergen was 10.2%. These results were in contrast to studies done in countries like the USA and Sweden refer to the fact that in these countries more than 60% of the households keep pets and more than 161 million of these pets were dogs and cats [14], as only a few families in Egypt keep cats or dogs as pets in their homes.

Regarding molds, the most common fungal allergen was found to be *Alternaria*. *Alternaria* (16.1%) followed by *Aspergillus fumigatus* (13.6%) which is nearly similar to studies in the USA [15] and Sudan [16]. Least prevalent mold was found to be *Cladosporium* with 1.7% similar to study in the Kingdom of Saudi Arabia [16].

About 25.4% of the patients showed undetectable-specific IGE in serum against common aeroallergen. The explanation for these negative results could be due to the lower sensitivity serum-specific IGE than SPT [17], and the fact that patients were allergic to particular allergens that were not tested in the study.

Since we have not yet found any studies conducted on this subject in our region, we report here for the first time, the most common aeroallergens detected by serum-specific IGE between allergic rhinitis patients in Egypt so we recommend further comprehensive research.

Some of the limitations of this study consisted of a 1-year period, which limit the generalization and comprehensive comparison of the results over the years, so large sample containing different years, with correlation with geographical residence of the patients with common aeroallergens found is needed.

Conclusion

This study assessed the most common aeroallergens among allergic rhinitis Egyptian patients. The results showed the significance of mites and pollens allergens and the polysensitization pattern among the allergic rhinitis patients in Egypt. This study may be of use to allergist in any diagnostic or therapeutic strategy for the treatment of patients with allergic rhinitis.

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Authors' contributions

HE and AA conceived, designed and conducted the study, HE analyzed the data. HE and AA wrote the paper and contributed to manuscript revision. All authors have read and approved the manuscript.

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Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available because it is private data considering our patients, but are available from the corresponding author on reasonable request.

Declarations**Ethics approval and consent to participate**

It was done in accordance with the ethical standards of the Faculty of Medicine, Ain Shams University Ethical Committee, but reference number is not applicable. Informed verbal and written consent was obtained.

Consent for publication

Not applicable.

Competing interests

Prof Ahmed Atef is a co-author of this study. He declares a competing interest for this submission. He hasn't handled this manuscript. The rest of the authors have no conflict of interest to declare.

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