Specific IgE Assay for Respiratory Allergens in Patients with Atopy in Ahvaz, Iran

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ABSTRACT

Background: The frequency of sensitization to respiratory allergens is different in various geographical regions. **Objective:** To determine the level of specific IgE to respiratory allergens in patients with atopy in Ahvaz, Iran. **Methods:** In this retrospective cross-sectional study, the total and specific IgE data were recorded for 408 patients with allergic rhinitis and asthma referred to allergy diagnostic laboratory in Ahvaz from 2014 to 2017. The specific IgE was measured for nine respiratory allergens including *Salsola kali, Triticum aestivum, Lolium perenne, Salix caprea, Prosopis juliflora, Dermatophagoides farinae, Aspergillus fumigatus, Alternaria alternata, Blatella germani* using the ImmunoCAP system (Thermofisher-Phadia, Uppsala, Sweden) in referred patients. **Results:** The median (IQR) age of participants was 15.5(27) years. The most common outdoor aeroallergens were *Salsola kali* (42.9%), *Lolium perenne* (32.2%), and *Salix caprea* (28.2%) while *Dermatophagoides farina* (21.1%) and *Blatella germanica* (20.6%) were the most dominant indoor sensitizers. Sensitization to at least one allergen was found in 57.4% of the patients. The prevalence of IgE sensitization to all respiratory allergens was higher in males. The prevalence of IgE sensitization to molds including *Aspergillus fumigatus* and *Alternaria alternata* significantly decreased with increased age. **Conclusion:** The pattern of allergen-specific IgE showed that *Salsola Kali* and *Lolium perenne* are the most common aeroallergens in allergic patients. This finding demonstrates the high frequency of IgE sensitization to outdoor allergens in the southwest of Iran.

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Keywords: Aeroallergen, Allergy, Immunology, Specific IgE

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INTRODUCTION

The prevalence of IgE-mediated hypersensitivity reactions are increasing and accordingly are considered as a health problem worldwide (1). As reported by world allergy organization (WAO), hundreds of millions of people presently have allergic diseases especially asthma and allergic rhinitis (2). According to the national study, over 15% of people in Khuzestan (a province in a southwest of Iran with 4.71 million people) have been reported with asthma symptoms (3). This high prevalence of respiratory allergies especially asthma in Ahvaz could be due to semi-humid climate, dust storms, and environment pollution (4).

Aeroallergens are divided into two groups including outdoor such as pollens and molds and indoor allergens such as house dust mites, animal dander, and molds (5). It is worth mentioning that molds could be included in both groups (6). Pollens as the most important constituents of inhalant allergens affect about 40% of atopic patients (7, 8). Paramesh has reported that respiratory allergies could be exacerbated as the result of emerging new allergic plants as well as some environmental and climate changes such as pollution and global warming (9). Moreover, the development of these allergies depends on other factors such as genetics, age, gender, race of the patients, and exposure to infectious diseases (10). Furthermore, the frequency of respiratory allergens differs extensively between different geographical regions (11).

The analysis of allergic sensitization to allergens is usually carried out by in vivo (skin prick test) or in vitro tests (allergen specific Immunoglobulin E, such as ImmunoCAP) (12). In this study, ImmunoCAP tests were performed for detecting allergen-specific IgE as a hallmark of allergic sensitization. High accuracy, acquisition of accurate quantitative results, and minimizing binding of other isotypes such as IgG could be considered as major benefits of ImmunoCAP test (13). Presence of cross-reactive proteins such as profiling (14) and cross-reactive carbohydrates determinants (CCDs) in some allergens such as pollens and food plants may develop false positive results in some patients (15).

According to a recent meta-analysis, the total prevalence of sensitization to at least one allergen was 59% in the patients with allergic disorders in different regions of Iran. Furthermore, pollens in warm and dry cities and mites in coastal areas of Iran were determined as the most common aeroallergens (16). However, to the authors' best knowledge, few publications are available in the literature that addresses IgE sensitization pattern to aeroallergens in Ahvaz, Iran. The present study aimed to determine the frequency and level of respiratory allergens sensitization by ImmunoCAP in Ahvaz in order to prepare a suitable context for the prevention, diagnosis, and treatment in patients with allergy.

MATERIALS AND METHODS

This is a retrospective cross-sectional study involving specific IgE results of 408 patients with asthma and allergic rhinitis symptoms that was conducted between January 2014 and September 2017 in Ahvaz. The specific IgE results of patients attended to allergy diagnostic laboratory were recorded. About 5 ml of blood was obtained from all subjects. After separating the serums, they were stored at -20℃. Nine common aeroallergens including *Salsola kali, Triticum aestivum, Lolium perenne, Salix*

caprea, Prosopis juliflora, Dermatophagoides farinae, Aspergillus fumigatus, Alternaria alternata, and *Blatella germanica* were selected based on the previous local studies (17). Total IgE and specific IgE levels were measured by means of the ImmunoCAP system (Thermofisher-Phadia, Uppsala, Sweden) as instructed by the Manufacturer. Total and specific IgE tests were carried out in the Department of Laboratory Medicine, University Hospitals Leuven, Leuven, Belgium. According to the manufacturer instructions, the specific IgE level more than 0.35 kU/L was considered as positive. The positive specific IgE to two and more allergens was considered as poly-sensitization.

Statistical analysis. Data were analyzed using IBM SPSS version 20. The frequency and percentage of sensitizations to respiratory allergens were determined. Kolmogorov-Simonov test was utilized to determine the normality of quantitative variables. Median (Q1, Q3) and Interquartile range (IQR) were calculated to describe non-normal variables. The Pearson's chi-square test was used to evaluate the association between two categorical variables. A p-value < 0.05 was considered as significant. To draw the graph, Prism 5 (Graphpad Software Inc., La Jolla, CA, USA) was applied.

RESULTS

The median age of total patients was 15.5 years old (Q1, Q3=8, 35). A total of 232 (56.3%) subjects were male. The median level of total IgE was 133 KU/L (Q1, Q3=50,350). No statistically significant difference was found for total IgE concentration according to sex (Median: Male=151kU/L, Female=132kU/L). The frequency of sensitized patients to at least one aeroallergen was 234 (57.4%). The frequencies of mono and polysensitization to aeroallergens were 13 and 43.9%, respectively.

The prevalence of aeroallergens sensitization is shown in Table 1 regarding sex group. As the results depicted, the prevalence of IgE sensitization to all aeroallergens was higher in males. This difference was meaningful for cultivated wheat, ryegrass, willow, Aspergillus fumigatus, and Alternaria alternata.

Table 1: The prevalence of IgE sensitization to aeroallergens according to sex groups in Ahvaz

Allergens	Total Prevalence N (%)	Male N (%)	Female N (%)	P Value
At least one allergen	234(57.4)	141(60.8)	93(52.8)	0.10
Russian thistle (*Salsola kali*)	174(42.9)	107(46.3)	67(38.8)	0.10
Cultivated wheat (*Triticumaestivum*)	109(26.7)	73(31.5)	36(20.5)	**0.01**
Rye-grass (*Lolium perenne*)	131(32.2)	84(36.2)	47(26.9)	**0.04**
Willow (Salix caprea)	115(28.2)	77(33.2)	38(21.6)	**0.01**
Mesquite (*Prosopisjuliflora*)	95(23.3)	62(26.7)	33(18.8)	**<0.05**
Dermatophagoidesfarinae	86(21.1)	52(22.4)	34(19.3)	0.44

Aspergillus fumigatus	51(12.5)	36(15.5)	15(8.5)	**0.03**
Alternaria alternata	60(14.7)	48(20.7)	12(6.8)	**<0.001**
Cockroach, German (*Blatellagermanica*)	84(20.6)	50(21.6)	34(19.3)	0.58

Table 2 presents the frequency of sensitization to aeroallergens with regard to age groups. Sensitization to at least one allergen, Russian thistle, ryegrass, Aspergillus fumigatus, Alternaria alternata, and German cockroach was significantly different among age groups. The prevalence of IgE sensitization to molds including Aspergillus fumigates and Alternaria alternata significantly decreased with an increase in age (P<0.001).

Table 2: The prevalence of IgE sensitization to aeroallergens according to age groups.

Allergens	<6y(n=65) N (%)	6-18y(n=148) N (%)	>18y(n=195) N (%)	P value
At least one allergen	22(33.8)	88(59.6)	124(63.6)	**<0.001**
Russian thistle (*Salsola kali*)	13(20)	67(45.3)	94(48.7)	**<0.001**
Cultivated wheat (*Triticum aestivum*)	11(16.9)	41(27.7)	57(29.2)	0.14
Rye-grass (*Lolium perenne*)	13(20)	45(30.4)	73(37.6)	**0.02**
Willow (*Salix caprea*)	12(18.5)	47(31.8)	56(28.7)	0.13
Mesquite (Prosopis juliflora)	11(16.9)	37(25)	47(24.1)	0.40
Dermatophagoides farinae	13(20)	28(18.9)	45(23.1)	0.62
Aspergillus fumigatus	14(21.5)	26(17.6)	11(5.6)	**<0.001**
Alternaria alternata	15(23.1)	35(23.6)	10(5.1)	**<0.001**
Cockroach, German (*Blatella germanica*)	6(9.2)	27(18.2)	51(26.2)	0.009

Figure 1 shows the box plot of specific IgE concentration to nine aeroallergens in the patients with asthma and allergic rhinitis. As the results revealed, the median of specific IgE level to Salsola kali, Alternaria alternata, and Lolium perenne was higher compared to other allergens.

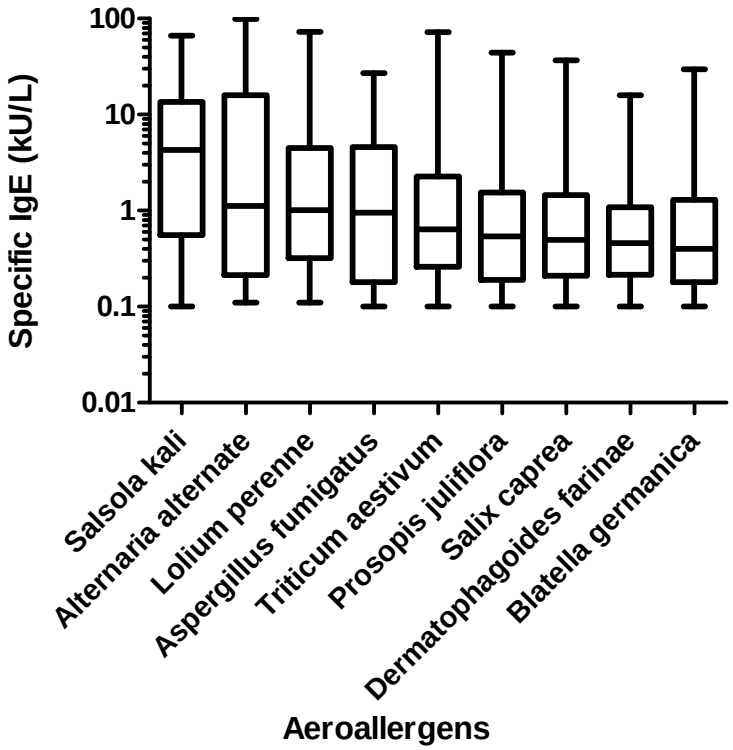

Figure 1. The box plot of specific IgE concentration (KU/L) to aeroallergens.

DISCUSSION

The focus of this study is on the profile of aeroallergens sensitization in allergic patients using the ImmunoCAP technique in Ahvaz, Iran. The frequency of sensitized patients to at least one inhalant allergen was 57.4%. This study has shown that Russian thistle and Dermatophagoides farina are the most frequent outdoor and indoor sensitizers, respectively. Investigational efforts to determine sensitization profiles within different geographical regions could be helpful in the prevention and treatment of local allergies.

Our findings are in contradiction with the previous study by Farrokhi et al. who reported indoor allergens such as house dust mites and Alternaria alternata as the most common aeroallergens in the southwestern part of Iran (i.e., Bushehr Province)(18).Ahvaz is not a coastal city with humid weather and it could be the reason for this controversy. The profile of common regional aeroallergen is affected by geo-climatic changes and atmospheric pollution (19).

Salsola kali was identified as the most common aeroallergen in allergic patients. This finding is in line with results reported by Assarehzadegan et al. in Ahvaz and other studies in Iran (17, 20, 21). Russian thistle was also reported as one of the most allergenic pollen causing allergic reactions in neighboring countries (22). The inhalation of mesquite (*Prosopis juliflora*) pollen is one of the leading causes of allergic respiratory symptoms in Khuzestan province (17). In our study, the frequency of mesquite and willow was found to be 23.3% and 28.2%,respectively, which was lower

than the results of other studies with skin prick test (17, 23).This dissimilarity could be attributed to the difference between used methods (in vivo or in vitro)(24).

The current study indicated that German cockroach is the second prevalent aeroallergen among indoor allergens. Cockroach allergies are common in southwest cities such as Shiraz and Ahvaz that could be due to the high rate of cockroach infestation in warm weather (25).

No statistically significant difference was found for total IgE concentration between sex groups. In the literature, the effect of sex differences in total IgE is not consistent. Some authors have observed higher total IgE levels in men (14-16), while others did not find significant differences.

The prevalence of specific-IgE sensitization to all aeroallergens was higher in males. This difference was meaningful for cultivated wheat, ryegrass, willow, Aspergillus fumigatus, and Alternaria alternata ($P < 0.05$). This finding is in accordance with the results of Haftenberger et al. and might be attributed to different exposure levels to aeroallergens (26) and the sex variation to develop an immune response (27). Such difference between genders cannot reveal the actual prevalence among the general population. However, in a large sample study on patients with respiratory allergies, Bjerg et al. found a higher prevalence of allergic sensitization in men that may be resulted from more exposure of men with allergens rather than women because men work outside more; therefore, exposure and sensitization to outdoor allergens will be more (28).

In the present study, IgE sensitization to aeroallergens was determined among different age groups. IgE sensitization to at least one allergen, *Salsola kali, Lolium perene, Aspergillus fumigatus, Alternaria alternata*, and German cockroach was significantly different among age groups. Some studies have shown that sensitization to some aeroallergens (such as *Salsola kali* and *Cynodon dactylon, dermatophagoides pteronyssinus*) increases up to middle age (29, 30).

Our findings showed that the frequency of IgE sensitization to molds significantly decreased with age ($P<0.001$), which is in accordance with the study of Newson et al. who reported a decreasing trend in the prevalence of aeroallergens sensitivity among older patients (24). The frequency and severity of IgE mediated hypersensitivities could be affected in older adults as a result of Immunosenescence (31). This occurrence in the older ages can also be explained by immune tolerance due to more regular exposure to allergens.

Further investigation is needed, however, to exclude the false positive results that may be stemmed from cross-reactivity between allergens. This study may suggest the use of these aeroallergens in any diagnostic panel or treatment strategy for the management of allergic patients.

Conclusion: We found about 50% prevalence of specific IgE positivity to respiratory allergens among allergic patients in Ahvaz. The pattern of allergen-specific IgE showed Russian thistle as the most common sensitizing outdoor allergen and *Dermatophagoides farina* allergen in this patient subset. Sensitization to outdoor aeroallergens was more common compared with indoor allergens in Ahvaz.

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