**LETTER TO THE EDITOR**
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# Frequency and Pattern of IgE-mediated Sensitization to Aero and Food Allergens in Ahvaz, Province of Khuzestan in Southwestern Iran

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## ABSTRACT

Efficient diagnosis of allergy and proper treatment need identification of the causative allergens eliciting clinical symptoms. The present study was performed to identify the most common aero- and food allergens and determine the pattern of sensitization among people of Ahvaz (southwestern Iran), one of the most polluted cities worldwide.

Based on the physical examination and medical records, patients were referred to the Allergy laboratory for "in vitro" IgE determination. Specific and total IgE was determined by the ImmunoCAP system (Thermo Fisher-Phadia, Uppsala, Sweden).

A total of 666 consecutive patients (51.1% female) were tested for 202 different allergens. The majority of requests (57%) belonged to food allergens. Sensitization to at least one allergen was found in 47.6% of patients. In a selected group of allergens for which specific IgE had been tested in at least 100 patients, the most common sensitizing aeroallergens were Russian thistle, grass pollen, and willow; while wheat, honey, and shrimp were the most frequent food allergens, respectively.

Sensitization profiles based on measurement of specific IgE indicated that Russian thistle, grasses, and wheat were the most prevalent allergens in people with allergic symptoms living in Ahvaz.

**Key Words:** Allergen; Hypersensitivity; Iran; Prevalence; Specific IgE

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## INTRODUCTION

Allergic diseases affect more than 25% of individuals in developed countries[1] and are a heavy socio-economic burden worldwide.[2] According to a World Health Organization air quality survey, Ahvaz, the capital of the Khuzestan province has been ranked among the most polluted cities in the past five years, mainly due to the constant dust storms (http://www.who.int). As a consequence, the rate of allergic and respiratory diseases has sharply increased in the last decade.[3]

Aeroallergens have been considered as triggers in the pathogenesis of some allergic diseases and may vary according to the studied region.[2] Additionally, the frequency of food allergy, as well as the type of food allergens, dependents on the geographical region, ethnicity, dietary habits, gender, and on the age of the patients.[4]

Despite the increasing prevalence of allergic diseases in this region, there are not enough studies to provide data about IgE sensitization to airborne allergens. To the best of our knowledge, no study exists about IgE sensitization to food allergens in this region.

It is very important to identify common allergens, for efficient allergy diagnosis and proper treatmen. In the current study, we present an analysis of allergic sensitization in South-West of Iran in order to identify the spectrum and pattern of the most common aero- and food allergens (and its relation to age and gender) by measuring "in vitro" specific IgE.

## MATERIALS AND METHODS

### Study Design

This retrospective cross-sectional study has been performed between 2013 to 2015 on 666 patients presenting different allergic symptoms. The demographic data and medical records of patients were collected from diagnostic laboratory in Ahvaz. Five ml blood sample had been taken from patients. The serum was separated and stored in -20ºC. Informed consent had been obtained from all subjects before shipping the samples.

Allergens were selected by the physician based on the clinical history. Total IgE and specific IgE level was determined by the ImmunoCAP system (Thermofisher-Phadia, Uppsala, Sweden) according to manufacturer's instructions. The ImmunoCAP tests were done in Department of Laboratory Medicine, University Hospitals Leuven, Leuven, Belgium.

The results are reported as kU/L. The cut-off for positivity was≥0.35 kU/L. The participants were categorized into three age groups [<6y (201), 6-18y (147), and>18y (318)]

### Statistical Analysis

SPSS version 18(SPSS Inc., Chicago, USA) and excel were used to analyze the study data. Median and quartiles ($25^{th}$=Q1, $75^{th}$=Q3) were calculated. Pearson chi-square was used for assessment of the association between categorical variables. Mann-Whitney test was used for determination of the difference between total IgE among two genders. Prism 5 (Graphpad Software Inc., La Jolla, CA, USA) was used for drawing the graphs.

## RESULTS

51.1% of 666 patients were female. The median age of subjects was 14 years (IQR=32)(1-68 years). The median of total IgE level for the total population was 118 kU/L (Q1, Q3=36, 319.5). The median of total IgE level in patients sensitized to at least one allergen was 268 kU/L (Q1, Q3=121, 588). There was a statistically significant difference in total IgE between male (median=126.5 kU/L) and female patients (median=109 kU/L) ($p$=0.03).

According to the distribution of requested allergens, 202 different allergens were tested. The majority of requests belonged to food allergens (57%).

Specific IgE values of≥0.35 kU/L, indicating sensitization, were found in 1388 out of 8766 tests, comprising 317 patients.

Sensitization to at least one allergen was found in 47.6% of all patients. Mono-sensitization and poly-sensitization were seen in 15.32% and 32.27% of patients, respectively. On the total group of patients, the prevalence of food and aero-sensitization was 37.8 % and 49.2%, respectively. Eighty patients (17.2%) were simultaneously sensitized to food and aeroallergens.

There was a statistically significant relationship between sensitization to food and aeroallergens and gender among all patients. Male patients demonstrated higher prevalence of food and aeroallergen sensitization compared to female patients ($p$<0.001, $p$=0.01) (Figure 1a).

Figure 1a

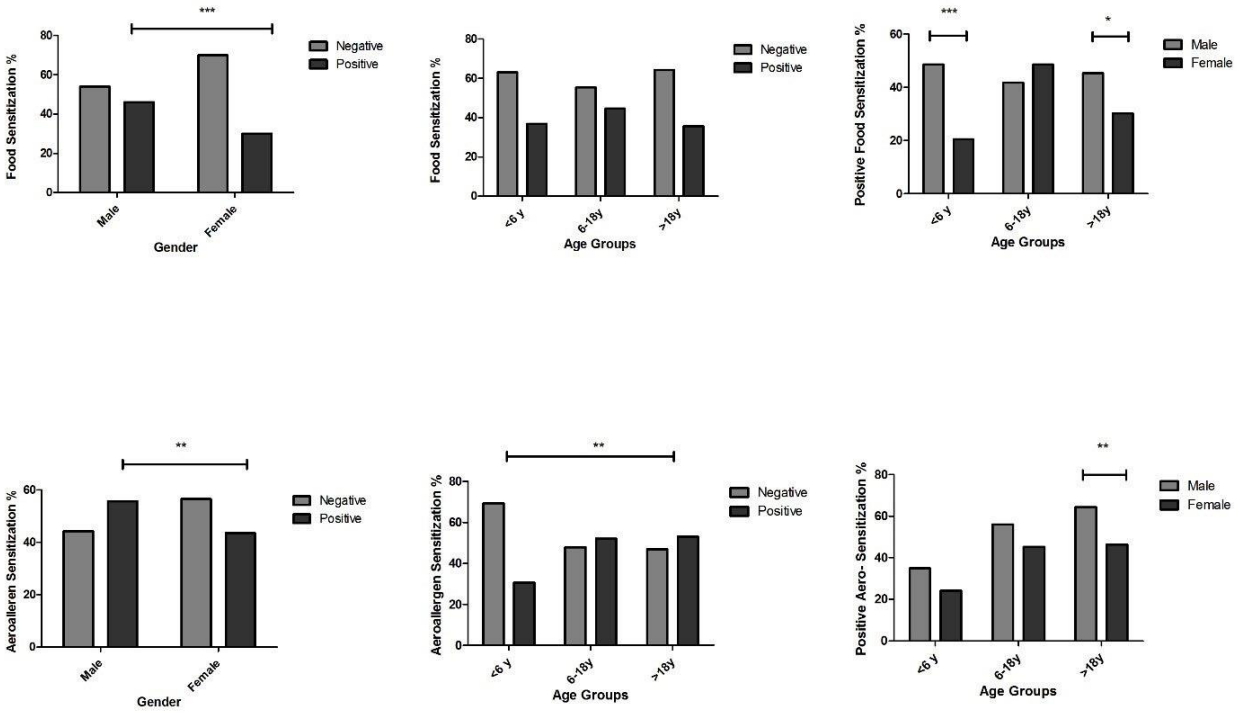


Figure 1b

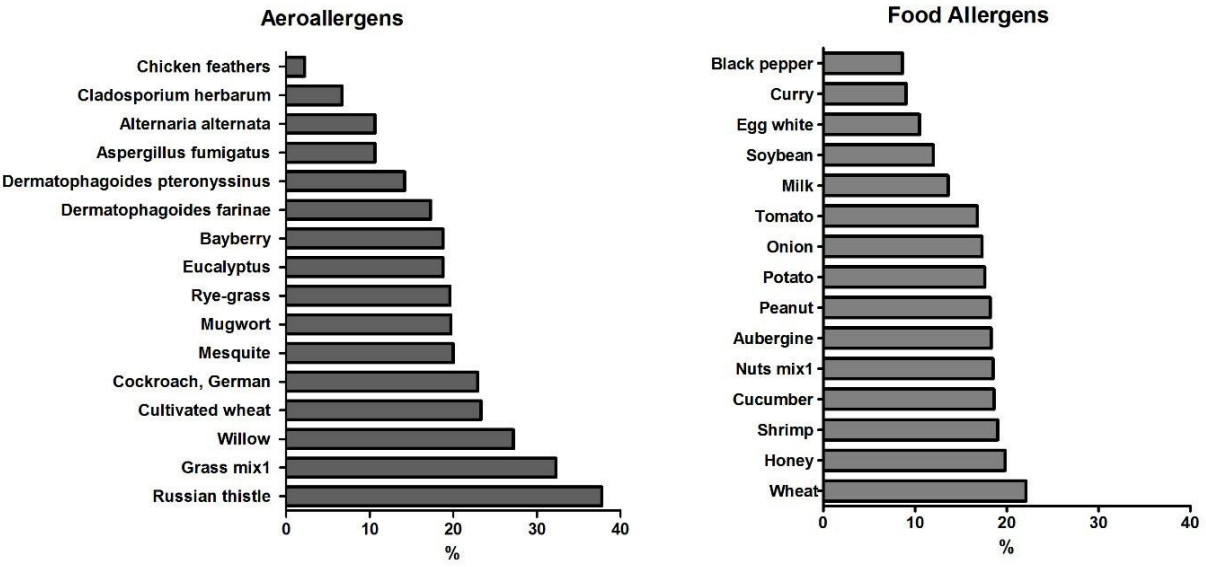


**Figure 1: a) The frequency of food and aero allergen sensitization according to gender and age groups for all allergens. b) The most common aero-allergens and food allergens in patients with allergic symptoms (allergens were requested at least 100 times). Grass mix1 ("Dactylis glomerata, Festuca elatior, Lolium perenne, Phleum pratense, Poa pratensis).**
***<0.05, **<0.01, ***<0.001**

As shown in figure 1b, the most common outdoor aeroallergens that were requested at least 100 times were Russian thistle, grass pollen mixture, and willow. The most common indoor aeroallergens were German cockroach, Dermatophagoides farinae and pteronyssinus. Among food allergens, wheat, honey, and shrimp were the most commonly tested allergens.

The percentage of food sensitization in three age groups was: <6y (n=65 out of 176, 36.9%), 6 - 18y (n=37 out of 83, 44.6%),>18 y (n=74 out of 207, 35.7%). The frequency of aeroallergen sensitization in different age groups was as follows: [<6y (n=22 out of 72, 30.6%), 6-18y (n=61 out of117, 52.1%),>18 y (n=138 out of 260, 53.1%)].

Among allergens requested at least 100 times, the highest concentration of specific IgE was recorded for Russian thistle, milk, Alternaria alternata, and Aspergillus fumigates, respectively.

## DISCUSSION

The present study showed that food allergens, followed by tree pollen allergens constitute the dominant requests in 666 patients with allergic symptoms referred to the Allergy laboratory in Ahvaz for determination of total and specific IgE levels.

Similar to some other studies,[5,6] our findings showed higher concentrations of total IgE in male compared to female patients. Among the allergens requested at least 100 times, specific IgE level (≥0.35 kU/L) were found to be most frequently positive for Russian thistle, grass pollen mix, and willow (aeroallergens) and for wheat, honey and shrimp (food allergens).

Russian thistle (*Salsola kali*) is a member of the Chenopodiaceae family producing allergenic pollen in different regions of the world and is especially abundant in semi-desert countries such as Iran.[7]

There is a significant association between food and aero-sensitization and gender. This association of food sensitization and gender was also found by Abbas et al. in 2015[8]. According to some studies, there is a higher prevalence of sensitization in male patients less than 8y old compared to female patients in the same age group. This difference may be attributed to a physiological phenomenon called immune dimorphism.[9]

A lot of foods have been recognized as allergenic aliments. According to Sicherer et al.,[10] fruits, shellfish, and vegetables are the most common food allergens in adults; while cow's milk, peanut, and tree nuts are common food allergens in children. A recent study from the Mayo Clinic[11] reported cow's milk, wheat, egg white, egg yolk, and peanut as the most important food sources responsible for allergic reactions. In the present study, the most frequent requests for food allergens were cow's milk, wheat, and egg white as well. Among these patients, 22.1% had positive specific IgE to wheat. Since Khuzestan is the one of the main centers cultivating wheat in Iran, elevated wheat specific IgE and consequent wheat sensitization seem to be important.

It is interesting that IgE sensitization to honey is significantly high in our study. Since some food products such as honey contain pollen grains, patients sensitized to the related pollen grains can manifest clinical symptoms after ingestion of honey.[12]

We found German cockroach and Dermatophagoides farinae as the most common indoor allergens in Ahvaz. This is in agreement with another study in Tehran where cockroach sensitization was found to be as high as 18% in allergic patients less than 18 years old.[13] Humidity and hot weather in Ahvaz could be responsible for this significant sensitization to cockroach and house dust mite.[14]

Shrimp was determined as the third most frequent food allergen in our patient population. Detection of shrimp-specific IgE might be due to clinically relevant cross-reactivity between crustacean and house dust mite; especially due to the presence of tropomyosin, whereby the primary sensitization is believed mostly to be a respiratory allergy to mites, which in some individuals may cause food allergic reactions to shellfish.[15]

Poly-sensitization has been observed in more than 60% of allergic patients. However, for therapeutic decision making and identifying whether IgE antibodies are directed against primary, species-specific allergens, or cross-reactive allergens, molecular diagnostics may be helpful.[1] We found, for example, sensitization for wheat allergen together with sensitization to peanut, soybean, cucumber, tomato, eggplant, potato, onion, and grass mixture. This could be due to the presence of pan allergens such as profilin, which are present in allergens from plant and food origin.[16] However, the limitation of our study is that all patients have not been tested for same allergens.

In spite of more requests for evaluation of food allergens, the prevalence of aeroallergen sensitization is

higher than the prevalence of food allergen sensitization. In some cases, primary exposure to inhalant allergens could result in secondary food allergy due to cross-reactive allergenic molecules. Sensitization profiles based on measurement of specific IgE indicated that the most prevalent allergens found in residents of Ahvaz were Russian thistle, grasses, and wheat.

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