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Common Aeroallergens in Patients with Asthma and Allergic Rhinitis Living in Southwestern Part of Iran: Based on Skin Prick Test Reactivity

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ABSTRACT

Aeroallergens continue to have a key role in the pathogenesis of asthma and allergic diseases and have recently received increased attention in medical research throughout the world. The prevalence of aeroallergens vary in different regions, depending on the type of climate. The aim of the present study was to determine prevalence of the sensitivity to aeroallergens among patients with asthma and allergic rhinitis (AR), based on skin prick test (SPT) reactivity in the province of Bushehr, Iran.

In this cross-sectional study, 743 patients were enrolled. The participants had asthma and AR and reacted to at least one allergen with SPT. Skin prick test with standard extracts including house dust mites (HDMs), animal dander, molds and pollens were performed on patients according to the herbal geography of the area.

The male to female ratio and mean age of the patients were 1.03 and 27.6± 15.4 year, respectively. Out of 567 patients with AR, the common aeroallergens were HDMs (88.5%), molds (82.9%), animal dander (79.5%), weeds (77.6%), trees (75.5%) and grass pollen (71.5%). Moreover, among 176 patients with asthma, the prevalence of aeroallergens were HDMs (90.5 %), molds (80.7%), animal dander (77.5%), weeds (73.3%), trees (73.3%) and grass pollen (67.9%). The sensitivity to animal dander, Chenopodium album and Russian thistle pollens were significantly associated with the severity of AR. Moreover, sensitivity to animal dander such as cat and feather of birds, cockroach, Bermuda grass and Chenopodium album pollens were significantly associated with the severity of asthma.

The results of this study revealed that HDM was the most common sensitizing aeroallergen in patients with asthma and AR. Molds and animal dander as indoor allergens were also common aeroallergens. We suggest that the hot weather and ambient humidity in the region may be the main cause of the change in the pattern of SPT reactivity.

Keywords: Aeroallergen; Allergic rhinitis; Asthma; House dust mite; Skin Prick Test

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INTRODUCTION

Allergic diseases are hypersensitivity disorders of the immune system which occur through allergic inflammation induced by an allergen specific immunoglobulin E (IgE) mediated response.[1,2] The significant increase in the prevalence of the atopic diseases observed throughout the world in recent years indicates that different environmental factors are involved.[3]

The prevalence of respiratory allergies, including allergic rhinitis (AR), allergic rhinoconjunctivitis (ARC), allergic rhinosinusitis (ARS) and asthma are varied both within and between different countries.[4] Such variations have been determined to be 3-30% in different studies depending on the type of allergens existing in those countries.[5,6] In fact, aeroallergens play key role in the pathogenesis of respiratory allergic diseases. Pollens, molds, house dust mites (HDMs) and pets are the most common allergens.[6,7]

Allergic disorders are diagnosed by having the proper history of patients, physical examination and some paraclinical tests to find out about specific IgE. Skin prick test (SPT) continues to be the most appropriate diagnostic in vivo test for the assessment of specific IgE.[1] Moreover, avoiding exposure to allergens and also finding the best formulation of allergen immunotherapy which is based on the identification of common aeroallergens in the area are necessary.[7]

So far there has been no information regarding the common aeroallergens from southwestern part of Iran, Bushehr province. The aim of this study was to investigate the prevalence of various aeroallergens in the area and their involvement in sensitizing patients with allergic respiratory diseases.

MATERIALS AND METHODS

Study Population

This cross-sectional study was performed on the patients referred to allergy clinics, affiliated to the Hospital of Bushehr University of Medical Sciences, during the years 2012 to 2013. In the present study, 743 patients having symptoms of AR, ARC, sinusitis and asthma were enrolled. AR and asthma were classified based on Allergic Rhinitis and their impacts on Asthma (ARIA) and the Global Initiative for Asthma (GINA) guidelines, respectively. Demographic and anthropometric characteristics of the subjects including history, physical examination and SPT were documented for each patient.

Skin Prick Test

SPT was performed for all the patients by using regional common allergen extracts (Greer, USA). Allergens were selected for the study, based on the type of plants grown in the area and other allergens which were identified and introduced by the authorities from The Agricultural Research Center, Bushehr. Trees which commonly spread pollen (Ash, Date palm, Mulberry white, Oleaceae, Salicaceae and False acacia), grasses (Bermuda, Couch and Meadow grass), weeds (Chenopodium album, Russian thistle, Mustard and Sorrel), HDMs (Dermatophagoides farina and Dermatophagoides pteronyssinus), molds (Aspergilus fumigatus, Penicillium nonatum and Alternaria alternara), animals dander and cockroach extracts were used to be tested. SPT was performed according to the international guidelines[8] as a single-test on two fore-arms with lancets and standardized allergens. A wheal size ≥3 mm was measured as a positive reaction. Histamine hydrochloride (10 mg/ml) and glycerin saline were used as positive and negative controls, respectively. All subjects who were analyzed had positive reaction to histamine and none of them had reactions to the negative control.

Analysis

The data were analyzed by SPSS version 21 software (Chicago, USA). Descriptive statistics, Chi-square and T test were used to examine and compare the relationship between the characteristics of the sample. *P* value <0.05 was considered as significant.

RESULTS

Demographic data

In the present study 837 patients were referred to the allergy clinic affiliated to the Persian Gulf Hospital, Bushehr, Iran. Out of these, 743 of them with the symptoms of asthma and AR who reacted to at least one allergen were enrolled for the study. The male/female ratio and the mean age of the subjects were 1.03 and 27.6± 15.4 years, respectively. Out of 743 participants, 187 (22.3%) were with asthma, 567 (67.7%) AR, 177 (21.1%) ARC and 245 (29.3%) ARS. Some of the patients had more than one allergic disease.

Table 1. Demographic Data, Signs and Symptoms of Patients who referred with Allergic Rhinitis or Asthma

Topics	Diagnosis	
	Allergic Rhinitis (%) (N= 567)	Asthma (%) (N= 187)
Smoking	13.4	20.3
Sex		
Male	51.8	54.5
Female	49.2	45.5
Age		
< 5 y	3.7	3.7
5-12 y	18	24.6
> 12 y	77.6	71.6
Nasal blockage	75	-
Rhinorrhea	81	-
Sneezing	74.8	-
Nasal pruritus	63.5	-
Nasal polyp	22	11.8
Dyspnea	-	78.1
Cough	-	80.2
Wheeze	-	65.8
Post Nasal Drip	60.8	51.9
Carpet	56.8	64.2
Pillow including feather	6.3	4.8
Sleep on Bed	38.7	28.9
Pets	21.8	19.2
> 1 year of onset	80.6	83.4

Patients with AR

There were 567 patients with AR, 49.2% female and 51.8% male. The male to female ratio and the mean age of the subjects were 1.07 and 27.2±17.6 years respectively. Smoking was reported in 76 (13.4%) subjects. There was a significant difference between the age groups with respect to the frequency of AR (p=0.006). Positive family history of atopy was seen in 85% of patients, 50% of our subjects used at least one of the antiallergic drugs in their drug history and 24% of the patients with AR, had asthma (Table 1).

The most common complaint from the patients with AR was rhinorrhea (81%) and nasal blockage (75%). Based on ARIA classification, intermittent and persistent AR was diagnosed to be as 13.7% and 86.3%, respectively. The percentage of asthma in patients with mild intermittent, mild persistent and moderate to severe persistent AR, was 2.6%, 7.9% and 9.7%, respectively. The increase in the prevalence of asthma was not associated with the severity of AR (p= 0.09). The common aeroallergens in patients with AR were HDMs (88.5%), molds (82.9%), animal dander (79.5%), weed (77.6%), tree (75.5%) and grass pollen (71.5%). In addition, sensitivity to animal dander (cat, dog and feather of birds) and weed pollen were significantly associated with the severity of AR (p=0.01) (Table 2).

Table 2. The prevalence of SPT reactivity to common aeroallergens according to ARIA based AR severity

Allergen	AR Severity		*P* value
	Intermittent (%) (mild, moderate to severe)	Persistent (%) (mild, moderate to severe)	
Dermatophagoides farina	13.9	86.2%	0.9
Dermatophagoides pteronyssinus	13.4	86.2%	0.7
Chenopodium album	9.6	90.4%	**0.035**
Russian thistle	12.4	87.6%	**0.0**
Ash Tree	10.4	89.6%	0.5
Alternaria alternara	14.2	85.8%	0.2
Cat dander	13.6	86.4%	**0.0**
Bermuda grass	14.4	85.6%	0.06
Feather	15.3	84.7%	**0.01**
Date palm	14.4	85.6%	0.4

Table 3. The prevalence of SPT reactivity to common aeroallergens according to GINA based asthma severity

Allergen	Asthma Severity			*P* value
	Mild persistent	Moderate persistent	Severe persistent	
Dermatophagoides farina	38.7%	43.5%	15.2%	0.9
Dermatophagoides pteronyssinus	37.4%	47.5%	15.2%	0.7
Ash Tree	34.4%	46.9%	18.8%	0.8
Russian thistle	33.8%	54.1%	12.2%	0.1
Feather	32%	53.3%	14.7%	0.1
Alternaria alternara	34.2%	51.9%	13.9%	0.2
Date palm	37.8%	45.9%	16.2%	0.7
Bermuda grass	28.4%	56.7%	14.9%	**0.02**
Cat dander	30.4%	50.7%	18.8%	0.7

Patients with Asthma

The total patients who suffered from asthma, was 187 (22.3%). Among these patients 85 (45.5%) were female and 102 (54.5%) were male. The male /female ratio and mean age were 1.2 and 28.8±17.1 year respectively. Also, 20.3% of them were smoker. There was no significant difference between the age groups with regards to the frequency of asthma (p>0.05). Among the patients with asthma 67.7% had AR and 10.9% had AR and eczema (Table 1). The severity of asthma according to GINA classification were 29.4% mild, 34.2% moderate and 11.2% severe persistent. Exacerbation of asthma was occurring more frequently in winter season (65.5%). Positive family history of asthma or at least one of allergic diseases was observed in 85% of patients. The common aeroallergens were HDMs (90.5%), molds (80.7%), animal dander (77.5%), weed (73.3%), tree (73.3%) and grass pollen (67.9%). Sensitivity to animals (cat and feather of birds), cockroach, Bermuda grass and Chenopodium album pollen were significantly associated with the severity of asthma, the p values were 0.001, 0.007, 0.02 and 0.003, respectively (Table 3).

DISCUSSION

The results of our study showed that the sensitizing aeroallergens among patients with AR and asthma were HDMs, molds, animal dander, weed, tree and grass pollens, respectively. It was observed that indoor allergens including Dermatophagoides farina, Dermatophagoides pteronyssinus (HDM), Alternaria alternara (mold) and animals, were more prevalent than outdoor allergens. With respect to the regional geography with high humidity and temperature, sensitization to the indoor allergens was expected. Usually because of such climate, people are forced to stay at home, and so they are more exposed to indoor allergens especially during summer and winter. On the contrary to our results, studies conducted in different cities of Iran including Shiraz, Tehran and Karaj with dry climate reported that the pollen from weeds, grasses and trees as outdoor allergens were the most common in patients with AR.[4,9] Therefore, it seems that indoor allergens (HDMs, molds, and animal dander) are the main cause of allergic respiratory diseases in the region. In other words, it can be stated that HDM was the most common aeroallergens in our study. Moreover the growth of HDM is mostly dependent on ambient humidity and high temperature, therefore the high incidence of HDM sensitization could be expected in Bushehr as well as in Singapore, Malaysia and Thailand.[10-14] Allergic responses to HDM is associated with airway hyperresponsiveness and it is the most important indoor allergen for asthma.[15-18] In spite of the high incidence of HDM in our patients, sensitization to animals, cockroach, Bermuda grass and Chenopodium album pollen were significantly related to AR and asthma.[19]

In addition, during our study it was found that sensitivity to animal dander (cat and feather) was significantly associated with the severity of AR. This could be as the result of increasing tendency to animal house keeping among people in the region. A relationship was found between the animal allergen exposure and increased prevalence of asthma and allergies. This could be explained in such a way that animal allergen remains for a longer time and leads to higher inhalation compared to other allergens. Moreover, it becomes widely distributed and is consistently present in homes that do not have animals.[20]

Accordingly, our study showed that Chenopodium album was the most common pollen by which the patients with AR were sensitized to. Moreover, Chenopodium album was the only allergen which was significantly associated with the severity of asthma. This could be justified that it is because of the common perennial weed which are grown mostly in late summer and flowering during season in the region. In agreement with our results, studies conducted in Tehran and Kuwait reported that Chenopodium album had been the most common sensitizing pollen in the area, while the other weed (Russian thistle), was the most common sensitizing pollen in Ahvaz.[1,9,21]

In the present study, it was observed that the prevalence of sensitivity to Ash tree pollen was high, however the cultivation of Ash tree in the region is low. The result of some studies indicated that there are cross-reactivity between different tree pollens as well as grass or weed which suggest that some common epitopes were present in unrelated plants.[22,23] It has been reported that there was cross-reactivity between ash and olive tree pollen which has been cultivated recently in the area.[24-26] In addition, the dusty air pollution, which contains different pollens has caused many problems in the area in recent years, this itself may have caused climate changes.[27,28]

Also our results showed that 85% of patients with asthma or allergic diseases had positive family history of atopy. In fact positive family history of atopy is a well-known risk factor for allergic diseases.[4,29] With regard to gender, no significant relationship was found among asthma, AR as well as SPT reactivity.

We found that 86.3% of patients had persistent AR of whom 9.7% had asthma. Among the patients with asthma, 67.7% had AR. Epidemiological and pathophysiological studies have suggested that AR and asthma are closely related diseases, because they often occur together and also AR increases the risk of asthma development.[30-32] Therefore, the identification of regional common aeroallergens and the decrease in exposure to allergen may lead to the amelioration of bronchial inflammation and the development of asthma.

With regard to our previous study that showed the increase in allergic diseases in the region which was thought to be due to aeoroallergens, this study was designed and conducted. One more reason to do this investigation was because of the adverse effects of the dusty air pollution in the area in recent years.[33]

In conclusion, aeroallergens are the most important triggers of allergic symptoms in asthma and allergic diseases. Our study showed that indoor allergens especially HDM was the most prevalent allergen in the region with hot and high humidity climate and the sensitivity to weeds pollen, cat and feather allergens were significantly associated with the severity of asthma or AR. Finally our study suggests that the above mentioned allergens could be used in the diagnostic or treatment strategies for the management of asthma and upper respiratory allergies.

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