

Original Article



## Study of respiratory allergens and associated factors in patients with allergic rhinitis referring to Imam Ali clinic in Shahrekord

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### Abstract

**Background and aims:** Respiratory allergens cause several problems for people with allergic rhinitis and are considered as a global challenge. This disease is an IgE-mediated nasal inflammatory disease that is triggered by the contact of the allergen. Therefore, this study was conducted to investigate respiratory allergens and associated factors in patients with allergic rhinitis who referred to a clinic in Shahrekord located in the southwest of Iran.

**Methods:** In this cross-sectional study, 200 patients including 100 males and 100 females were enrolled using a convenience sampling technique. Diagnoses were made according to clinical symptoms and observation. In addition, the skin prick tests were used to detect the allergens. Finally, data were recorded and then analyzed by Stata.

**Results:** Based on the results, 73.5%, 70.5%, 46%, and 43% of the patients were allergic to the following allergens including *Dermatophagoid pteronyssinus*, *Dermatophagoides farinae*, tree, and grass, respectively. Further, the mean height in the group with a positive and negative test for the inhaled allergens equaled 144.92±29.72 and 131.65±30.93, respectively, with a statistically significant difference ( $P < 0.05$ ). However, the mean weight, age, and the time at the onset of the disease were not significantly different between the two groups ( $P > 0.05$ ). Furthermore, the negative or positive reaction to the allergens failed to significantly differ with respect to gender, marital status, occupation, the county of residence, the area of residence, family size, and a family history of the disease ( $P > 0.05$ ).

**Conclusion:** Allergic rhinitis is regarded as a common disorder among teenagers and young adults in this setting. Allergy to one or more respiratory allergens was found to be highly prevalent in patients with allergic rhinitis and the highest rate of allergy was observed to the mites, followed by tree and grass.

**Keywords:** Allergens; Allergic rhinitis; Respiratory system

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### Introduction

An allergy refers to the excessive response of the immune system to a harmless substance (1). In addition, allergic rhinitis is one of the allergic reactions that develops in many people and causes a decline in the quality of life (2). Immune response plays a role in the incidence of allergic reaction by certain mechanisms such as the activation of IgE against the allergen and the production of certain cytokines such as interleukin (IL)-2, IL-3, IL-4, IL-5, IL-13, IL-10, IFN $\gamma$ , and M-CSF by T helper (h)1 and Th2 that cause inflammation in the nasal mucosa and thus produce mucus and the symptoms of this disease (3,4). The optimal clearance of different pathogen types encountered by the human body needs the selective activation of particular cellular and/or humoral immune responses. The coordination of the types of effector responses is directed

by Th cells by producing types 1 and 2 (Th1 and Th2 cell-associated) cytokines (5). Allergic rhinitis can be seasonal or perennial. Plant allergens such as grass and pollen are some of the agents of seasonal allergic rhinitis (6). Further, several examples of the agents of perennial allergic rhinitis include dust, active or passive smoking, indoor and outdoor fumes, microbes and parasites, animal proteins, dust mites, and roach (6,7).

However, the etiology of the allergic rhinitis is still a controversial issue and the interaction effect between the environment and genetic factors is considered a key factor in the development of allergic reactions such as rhinitis and asthma. Other epidemiological factors can be involved in the development of allergic reactions and the increased prevalence of the rhinitis as well. For example, changes in lifestyle and industrialization are assumed to

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play a role in the rate of developing allergic reactions in recent decades (8). According to a study conducted in the southwest of Iran, the prevalence of asthma and allergic reactions has undergone an increasing trend and 60% of the participants are found to suffer from respiratory allergen and asthma (9). During recent years, respiratory allergens have increased with human activities. Climatic changes and community industrialization are among the main causes of allergic diseases (10,11). Besides, with the epidemiological recognition of the disease and the determination of the prevalence of respiratory allergens, an important step can be taken to promote preventative plans, diagnosis, and treatments for this disease and thus reduce the additional costs which are imposed on the health care system (12,13). Accordingly, this study aimed to investigate respiratory allergens and related factors among patients with allergic rhinitis who referred to a clinic in Shahrekord in the southwest of Iran during 2016.

### Materials and Methods

This cross-sectional study (with the ethical number of IR.SKUMS.REC.1395.136) was conducted on patients with allergic rhinitis referring to Imam Ali clinic of Shahrekord in 2016. The sample size was determined 132 according to a relevant formula and in inspiration of a previous study in which the prevalence of skin prick testing (SPT) was 63.02%. Furthermore, 200 patients were enrolled using a convenience sampling method in order to increase the rigor of the study. Demographic data including age, weight, and height were recorded for each patient.

The inclusion criteria were the presence of the clinical symptoms of allergic rhinitis and at least three of these symptoms including sneezing, runny nose, itchy eyes and nose, as well as allergic rhinitis symptoms for longer than three days and, finally, suffering from the disease for at least four weeks. Moreover, suffering from underlying diseases, lacking sufficient data in the patient's medical file to complete the checklist, being under 2 years, taking an antihistamine and immune system inhibitors, suffering from cystic fibrosis, being under immunotherapy, and not volunteering to participate in the study were considered as the exclusion criteria.

SPT was used in addition to descriptions and clinical examinations in order to detect the allergens. The SPT is a suitable test to confirm the quick reaction to type 1 (Th1 cell-associated) allergy that indicates the specific IgE binding to the tissue representing atopy. Moreover, the SPT is convenient and safe and can be conducted on all patients including the children (14). To conduct the SPT, one drop of the allergen was placed on the forearm and upper arm, a small cutaneous scratch was made using the prick needle, and the reaction was compared with those to positive (histamine) and negative (normal saline) control 10 minutes later. The reaction was considered positive if

the response was over 0 mm swelling or hive or redness over 15 mm. Besides, the severity of the reaction to the allergens was measured according to Table 1 (15-17). Diameter over 3 mm was considered as a positive SPT result. Reaction to inhaled respiratory allergens such as shrubs, grass, trees, *Dermatophagoides farinae*, *Dermatophagoid pteronyssinus*, and the brunette was investigated as well and the obtained data were recorded in a checklist.

The data were analyzed by Stata with a 95% confidence interval. To investigate whether the difference was significant or not, *t* test and chi-square test, as well as the analysis of variance or its corresponding nonparametric test were used according to the distribution of the data.

### Results

The mean age, the mean weight, the mean height of the participants, and the mean time at the onset of the disease were  $19.87 \pm 14.61$  years,  $48.28 \pm 26.12$  kg,  $142.60 \pm 30.28$  cm, and  $39.32 \pm 18.54$  months, respectively.

The most frequent symptom was the runny nose (92%), followed by sneezing (78.5%), itching (74.5%), stuffy nose (71%), coughing (27%), redness (8%), and watery eyes (8%). The incidence of allergy to one or more allergens, *D. pteronyssinus*, *D. farinae*, tree, and the grass was 82.5%, 73.5%, 70.5%, 46%, and 43%, respectively. The mean difference in the qualitative variables between the groups of a positive and negative test of the inhaled allergens is shown in Table 2. Based on the results, there was no significant difference in mean age, the time at the onset of the disease, and the weight between the two groups, but the mean height of the group with positive reaction to allergy was significantly higher than that of the group with a negative reaction to the allergen ( $P=0.01$ ). Regarding qualitative variables, negative or positive reaction to the allergen represented no significant difference in terms of gender, marital status, occupation, the county of living, the place of residence, family size, and the family history of the disease ( $P>0.05$ ).

Additionally, itching, coughing, eye redness, watery eyes, sneezing, phlegm accumulation, and runny nose were not significantly associated with the allergen test result ( $P>0.05$ ).

Data analysis demonstrated that positive and negative reaction to the mites was not statistically significant regarding gender ( $P=0.5$ ), occupation ( $P=0.5$ ), county ( $P=0.8$ ), the place of residence ( $P=0.8$ ), family history

**Table 1.** Measurement and Interpretation of Skin Prick Test Results

Wheal Diameter (mm)	Degree
<3	0
3-3.99	+1
4-5.99	+2
6-8.99	+3
≥9 or pseudopodium	+4

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( $P=0.2$ ), and family size ( $P=0.9$ ), while allergic reaction to *D. farinae* and marital status was significantly associated ( $P=0.009$ ), the results of which are provided in Table 2.

Table 3 presents the data related to the comparison of response to tree and grass based on the qualitative variables. Based on the results, positive and negative reaction to grass and tree was not statistically significant for marital status, the place of residence, family history, and family size ( $P>0.05$ ).

As shown in Table 4, a positive or negative reaction to the mites, grass, and tree was significantly different for the height ( $P<0.05$ ). In addition, allergic reaction to *D. farinae* and tree significantly differed for weight and height ( $P<0.05$ ), whereas allergic reaction to *D. pteronyssinus* was significantly different only for the patients' height. Eventually, response to grass significantly varied respecting the onset of the disease and height ( $P<0.05$ ).

## Discussion

The present study was performed to evaluate the incidence of respiratory allergens and associated factors in patients with allergic rhinitis. The results of the current study revealed that many (82.5%) of the studied patients were allergic to different allergens and the highest rate of allergy was related to the mites (70.5%-73.5%), followed by the tree (46%) and grass (43%). The findings of a study in Iran demonstrated that the highest allergy rate, according

to the SPT, in patients with rhinitis belonged to two mites, namely, *D. farinae* and *D. pteronyssinus*, as well as the tree, *Alternaria alternata*, and roach (18). Further, another study reported that the prevalence of allergy was estimated at 85.6% among the patients with allergy referring to a hospital in the southwest of Iran. The highest allergy in the above-mentioned study was related to grass-based weed pollens and tree, and the mites were reported to be the most prevalent indoor allergens (19).

Similarly, based on the results of a study in the UAE, 71% of the patients with allergic rhinitis were sensitive to environmental allergens. Moreover, the findings demonstrated that 44% of the patients were sensitive to grass (20), which is consistent with the results of the current study. Bunnag et al showed that in the recent years, allergic rhinitis has increased by around three times in Thailand, and reported mites and grass as the most important agent of indoor and outdoor pollution, respectively (12).

According to the reports of a study in India, the prevalence of allergy was 28.7% and the highest rate of allergy was associated with dust (21). Furthermore, the findings of another study indicated that the incidence rate of allergy was age-dependent such that the highest rate of allergy to mites and trees was observed in individuals above 4 years. The rate of allergy to the trees was 56.4% and to the mites 56.8% in 10 to 12-year age group (22). Moreover, the prevalence of allergy to the allergens was

**Table 2.** Comparison of responses to *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae* according to qualitative variables

Variable (N)	<i>Dermatophagoides pteronyssinus</i>		P value	<i>Dermatophagoides farinae</i>		P Value	
	Negative	Positive		Negative	Positive		
Gender	Male (100)	27	73	0.8	30	70	0.9
	Female (100)	26	74		29	71	
Marital status	Single (134)	41	93	0.17	46	88	0.009*
	Married (66)	12	54		13	53	
Occupation	Laborer (6)	0	6	0.06	0	6	0.13
	Employed (17)	3	14		2	15	
	Housewife (38)	9	29		10	28	
	Self-employed (20)	4	16		5	15	
	Unemployed (119)	37	82		42	77	
County	Ardal (3)	0	3	0.8	0	3	0.6
	Boroujen (12)	3	9		3	9	
	Shahrekord (134)	40	123		46	117	
	Farsan (20)	9	10		9	10	
	Lordegan (2)	1	1		1	1	
	Kouhrang (1)	0	1		0	1	
Place of residence	City (165)	42	123	0.097	47	118	0.7
	Village (34)	11	24		12	23	
Family history	Positive (111)	26	85	0.57	31	80	0.9
	Negative (89)	27	62		28	61	
Family size	Small (13)	3	10	0.8	4	9	0.76
	Average (165)	45	120		49	116	
	Large (22)	5	17		6	16	

Note. \* $P<0.05$  is significant.

Table 3. Comparison of response to tree and grass according to qualitative variables

Variable (N)	Tree		P value	Grass		P value	
	Negative	Positive		Negative	Positive		
Gender	Male (100)	57	43	0.47	64	36	0.22
	Female (100)	51	49		50	50	
Marital status	Single (134)	74	60	0.54	80	54	0.70
	Married (66)	34	32		34	32	
Occupation	Laborer (6)	1	5	0.12	2	4	0.79
	Employed (17)	10	7		10	7	
	Housewife (38)	21	17		22	16	
	Self-employed (20)	12	8		11	9	
	Unemployed (119)	64	55		69	50	
County	Ardal (3)	2	1	0.56	2	1	0.73
	Boroujen (12)	4	8		5	7	
	Shahrekord (134)	91	72		96	67	
	Farsan (20)	9	10		10	9	
	Lordegan (2)	1	1		0	2	
	Kouhrang (1)	1	0		1	0	
Place of residence	City (165)	84	81	0.4	91	74	0.7
	Village (34)	28	11		22	12	
Family history	Positive (111)	57	74	0.58	59	52	0.3
	Negative (89)	51	38		55	34	
Family size	Small (13)	7	6	0.057	6	7	0.62
	Average (165)	92	73		98	67	
	Large (22)	9	13		10	12	

Table 4. Comparison of response to the mites, tree, and grass according to quantitative variables

Variable		Age	P value	Onset	P value	Weight	P value	Height	P value
<i>Dermatophagoid pteronyssinus</i>	Negative	16.43±15.46		44.62±75.75		40.59±27.35		131.28±32.00	
	+1	21.04±13.10	0.2	35.27±34.86	0.6	51.86±34.86	0.03*	149.13±26.37	0.01*
	+2	19.74±15.03		31.33±42.01		46.47±42.01		141.95±29.54	
	+3	22.66±13.79		44.75±37.49		55.80±49.37		150.35±28.45	
	+4	21.33±13.07		40.66±43.42		52.00±43.42		153.16±29.08	
<i>Dermatophagoide farina</i>	Negative	16.52±14.99		40.20±67.56		41.50±26.70		133.47±31.19	
	+1	17.83±12.46	0.1	24.76±29.45	0.6	47.59±26.14	0.08	143.80±30.40	0.04*
	+2	21.52±14.84		41.87±51.24		49.86±24.92		145.35±27.70	
	+3	22.35±14.25		43.51±51.64		54.08±25.40		148.07±30.60	
	+4	28.50±15.67		33.50±32.38		60.00±29.32		165.25±35.56	
Tree	Negative	18.63±15.22		35.18±26.18		44.43±27.19		137.39±30.58	
	+1	19.70±18.82	0.2	40.30±73.01	0.8	51.20±22.59	0.03*	150.70±28.14	0.003*
	+2	23.90±13.48		44.27±53.55		56.09±22.87		153.33±23.62	
	+3	17.08±14.80		45.96±47.97		44.65±28.50		135.55±35.15	
	+4	24.05±10.77		43.40±44.72		66.05±30.17		159.20±21.24	
Grass	Negative	18.42±15.27		36.03±57.82		44.33±26.87±		136.89±30.19	
	+1	21.15±13.60	0.4	32.35±52.59	0.02*	50.00±22.95	0.05	147.50±27.32	0.03*
	+2	20.71±14.46		37.94±42.86		51.38±26.96		146.46±32.37	
	+3	24.61±12.26		73.85±50.62		62.14±19.67		160.23±21.68	
	+4	21.16±13.25		13.16±12.42		49.00±22.51		148.00±30.51	

Note. \* $P < 0.05$  is significant.

studied among the patients with allergic rhinitis in Nigeria by the SPT and it derived at most 35% (23), which is lower compared to that of the current study. However, the result of this study demonstrated that the highest allergy

rate was attributed to mites and tree-based allergens (23), which is in line with that of the present study. Al-Abri et al in Oman found that the prevalence of perennial rhinitis was higher than that of the seasonal rhinitis and perennial

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rhinitis antigen was related to the mites in 80% of the participants (13).

In the current study, the mean height in the group with a positive reaction to the allergen was significantly higher than that of the group with a negative reaction, and allergic reaction to *D. farinae* was significantly associated with marital status. Conversely, the mean age, the time at the onset of the disease, and the weight were not significantly different between the two groups.

Manco et al reported that the circulating levels of IL-6, leptin, and PCR reduced in morbidly obese women after bariatric surgery. However, adiponectin increased with a decrease in cardiovascular risk. In addition, no significant changes were observed in the circulating TNF- $\alpha$  or the levels of circulating mannose-binding lectin and bactericidal/permeability-increasing protein. Contrarily, significant changes were found in the levels of sCD14 and visfatin in patients who lost more than 20% of their initial body mass index (BMI). Further,  $\alpha$ -defensin levels significantly decreased after the bilio-pancreatic diversion. In the molecules of the innate immune system, there was a positive correlation between MBL and the whole-body glucose uptake before and after weight loss. Changes in sCD14 were significantly related to those changes in BMI and insulin sensitivity as well (24).

In another study, immunomodulatory factors, age, body fat, and free testosterone levels were controlled and reported while there was no association between body height and the studied immune parameters in both sexes (25).

The results of a study in China demonstrated that family history and the current place of residence were among the risk factors for allergic reaction in patients with rhinitis, but such association was not significant regarding age (26). Further, the development of allergic symptoms was not significant for gender, age group, and body mass index and such association was not significant for marital status as well (27). Sinha et al reported that occupation and family history were two independent risk factors for the incidence of allergic reactions in patients with rhinitis (28). A study in the United States investigated socioeconomic factors and showed that gender, age, race, and low age were significantly associated with increased IgE mediators (29).

Obviously, the trend of seasonal changes, geographical region (20), latitude and weather (30), industrialization, and genetic history (31) are among the determinants of distribution and the prevalence of respiratory allergens. The difference in these factors can explain the inconsistency in the prevalence of allergens in different regions of the world.

## Conclusion

Based on the results, allergy to one or more respiratory allergens was highly prevalent in patients with rhinitis with the highest rate of allergy associated with the mites,

trees, and grass, respectively. In this study, rhinitis was diagnosed only based on clinical criteria, while it was more appropriate to use the available standard questionnaires in this respect. Therefore, it is recommended to investigate other chemical pollutants such as seasonal variations, smoking, and pollutants from motor vehicles in future studies. Moreover, natural allergens such as roach and animal proteins should be studied comprehensively. Finally, it is advised to study food allergens as a stimulating factor alongside respiratory allergens.

## Conflict of interests

None.

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