

THE PATTERN OF INDOOR AND OUTDOOR RESPIRATORY ALLERGENS IN ASTHMATIC ADULT PATIENTS IN A HUMID AND DESERT NEWLY DEVELOPED COUNTRY

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Summary

■ **Background:** Studies have shown that allergens are very important sensitizing agents in patients with asthma. Respiratory disorders such as asthma and allergic rhinitis are common in the State of Qatar.

■ **Objective:** To characterize the most frequent indoor and outdoor respiratory allergens involved in bronchial asthma and allergic rhinitis in the State of Qatar.

■ **Design:** A hospital-based prospective study conducted.

■ **Setting:** Allergy Laboratory at the Hamad General Hospital and Hamad Medical Corporation, Doha, State of Qatar.

■ **Patients:** Adult patients over 12 years of age diagnosed with bronchial asthma and/or allergic rhinitis who were referred for allergy skin prick test. 1106 adult patients recruited with respiratory diseases of suspected allergic origin who attended Allergy Clinic at the Hamad General Hospital, during three years from January 2001 to April 2003. Total of 1106 whom 607 were females (54.9%) and 499 were males (45.1%) and their mean was age 30 years (12-48).

■ **Methods:** Skin Prick Test [SPT] was performed on 1106 patients for common allergens whom The blood sample was taken for measuring specific IgE concentration.

■ **Results:** There were 1106 patients studied and 569 patients (51.4%) had positive skin prick test. All patients expressed clinical allergy, 464 patients (52%) had asthma and rhinitis, 286 patients (32%) had rhinitis alone and 137 patients (15%) had asthma alone. The population sample had a higher prevalence of diagnosed asthma among females (32.7%) than in males (29.8%) and also skin conditions such as eczema, pruritus, and urticaria higher in females (9.1%) than males (7.0%). Similarly, males had higher prevalence of allergic rhinitis (86.0%) than in females. there were 318 (55.9%) patients whose asthma developed before they were 10 years old. The percentage of asthmatic patients with a positive family history of asthma was 44%. The most common allergens detected in order of frequency were Dermatophagoides Pteronyssinus (Der p I) in 248 patients (41.6%), Dermatophagoides Farinae (Der f I) in 220 patients (36.9%), Cockroach allergen (Bla g I) in 192 patients (32.2%). The study showed that females are more exposed to pollen, grasses and tress, but males are mostly exposed to mites and insects. Furthermore, Molds and Yeast were common among males.

■ **Conclusion:** In conclusion, the frequency of indoor and outdoor allergens in state of Qatar, based on skin prick test study showed the dominance of house dust mites, pollen, grasses which are more or less same to other countries with similar and even with different climate. Reduced exposure to these agents will help control raising severity of these diseases.

Key-words: Allergy - Skin Prick Tests - Indoor and outdoor allergens - Qatar.

INTRODUCTION

Bronchial asthma, allergic rhinitis and atopic eczema are common allergic diseases. Their prevalence is increasing Worldwide (1-5), and is among the commonest causes of chronic ill health (6). Exposure to inhaled allergens is a natural occurrence in atopic and non-atopic individuals. Only atopic indi-

viduals show a measurable response like and sneezing, rhinorhea and wheezing (7-8). Skin prick test (SPT) is a valuable diagnostic test for determining the possible triggers of asthma and rhinitis (9). It can help determining reactivity to allergens and their prevalence in the community.

In most countries, sensitization to house dust mites is a leading cause of allergy and the exposure to these allergens is one of the causes of increasing cases of allergy worldwide (7-9). Although, this may be due to

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changes in diagnostic practice that the increased prevalence may be related to diagnostic transfer or a true increase in prevalence of symptoms is a true phenomenon (1-5, 10-11). Diagnosis of an allergic disorder is largely based on medical history, which can be confirmed by means of measurement of antigen-specific IgE levels or skin tests (12-13). The value of skin tests and allergen-specific IgE for predicting symptomatic allergy in patients has been evaluated in Western (4-8, 12-14) and in the Arabian Gulf Countries, Saudi Arabia (15-16) Kuwait (17-18) and UAE (9-19).

Data regarding the prevalence of reactivity to different allergens in atopic patients in the State of Qatar is lacking. This has prompted us to review all the results of skin prick testing in atopic patients evaluated in our laboratory during the period between January 2001 to April 2003. The aim of present study is to characterize the most frequent indoor and outdoor respiratory allergens involved in bronchial asthma and allergic rhinitis among adult patients in the State of Qatar.

SUBJECTS AND METHODS

PATIENTS

This is a hospital-based prospective study based on 1106 patients with respiratory, ophthalmologic diseases of suspected allergic origin, and dermatological allergic diseases who attended asthma and allergy clinics at the Hamad General Hospital, over a period two years from January 2001 to April 2003. A comprehensive information on patients included were: patients' age, sex, disease history and family history of atopic, respiratory allergy, allergic rhinitis, wheezing, duration of symptoms, history of asthma, and skin allergy diseases.

SKIN TESTING

All patients stopped anti histamines for 5 day prior to skin testing. Active urticaria or eczema were contraindications to skin test. Allergy skin tests were carried out according to the prick technique (20). The procedure for Skin prick testing [SPT], was standard, using "stallergipoint", on the volar surfaces of the forearms. Either histamine chlorhydrate 1% or codeine phosphate 1% was used as positive control, and glycerol-phenol normal saline as negative control. Allergy skin test material consists of standardized simple aqueous extract (stallergen, France) of protein from Dust mites, Cockroach, and Cat danders. The test starts with a drop of each extract placed on the volar surface of the

forearm, then a standard (stallergen, France) Lancetters is used to puncture the skin through the drop forcing a small amount of the extract into the skin. Test is measured in millimeters, and is considered positive if a wheal and flare reaction at least 3 mm develops at the skin sites within 15 minutes after testing and considered highly positive if the wheal diameter is more than a positive control. A wheal of at least 5mm in diameter with a negative phenol-saline control was considered a positive response. A negative test with a positive control is considered negative.

CHOICE OF ALLERGENS

Pollenic allergens were selected in accordance with a survey of the native and imported flora in the Qatar and from preliminary data obtained by one of us (HAS). Other classical inhalant allergens, e.g. mites, animals, insects were added to pollinic extracts. Allergenic extracts were obtained from various manufacturers (Stallergenes Institut Merieux, Bencard, Hollister-Stier). Some of these companies have since merged with other groups and are not known under those names anymore. All patients were tested with a battery of 175 allergens. Some other allergens were used from time to time.

STATISTICAL ANALYSIS

The Statistical Package for Social Science computer program (21) [SPSS] was used for statistical analysis. Data are expressed as mean and standard deviation (SD) unless otherwise stated. Chi-square analysis was performed to test for differences in proportions of categorical variables between two or more groups. In 2 x 2 tables, the Fisher exact test (two-tailed) was used instead of Chi-Square, in particular, when sample size was small. The Pearson's correlation coefficient was used to evaluate the strength of association between variables. The level $p < 0.05$ was considered as the cut-off value for significance.

RESULTS

There were 1106 patients studied of whom 607 were females (54.9 %) and 499 were males (45.1%). Their mean age was 30 years (12-48). The subjects were from different nationalities, 698 were Qataris (63.1 %) and 408 were non-Qataris (36.9 %). A total of 569 patients (51.4%) had positive skin prick test. All patients expressed clinical allergy, 464 patients (52%) had asthma and rhinitis, 286 patients (32%) had rhinitis alone and 137 patients (15%) had asthma alone. The characteristic of population and subject studied

are summarized in table 1. The population sample had a higher prevalence of diagnosed asthma among females (32.7%) than in males (29.8%) and also skin conditions such as eczema, pruritus, and urticaria higher in females (9.1%) than males (7.0%). Similarly, males had higher prevalence of allergic rhinitis (86.0%) than in females.

Table 2 shows the distribution by age of skin prick test results amongst the 1106 patients studied. Skin prick testing showed that, 569 patients (51.4%) had positive results, and 537 patients (48.6%) were found to be skin test negative and there were 318 (55.9%) patients whose asthma developed before they were 10 years old.

The percentage of asthmatic patients with a positive family history of asthma (44%) is shown in table 3. Results from other studies are included for comparison.

In the presents study, the most common allergens detected in order of frequency were Dermatophagoides Pteronyssinus (Der p I) in 248 patients (41.6%), Dermatophagoides Farinae (Der f I) in 220 patients (36.9%), Cockroach allergen (Bla g I) in 192 patients

(32.2%), table 4 presents sensitivity to aeroallergens, pollens, grasses and trees by gender. As can be seen from this table females are more exposed to pollen, grasses and tress, but males are mostly exposed to mites and insects.

table 5 shows sensitivity to aeroallergens Molds and Yeast by gender. As can be seen from this Table, males are more exposed to molds and yeast than females.

Total IgE level (>241 IU / ml) was strongly associated with doctor-daigned asthma ($p<0.01$) and allergic rhinitis ($p<0.001$), atopy ($p<0.0001$) and the presence of specific IgE antibodies to grass pollen ($p<0.001$), mite ($p<0.001$) and cockroaches ($p<0.01$), (table 6).

DISCUSSION

Allergen exposure can produce allergic sensitization in genetically susceptible persons resulting in symptomatic asthma on re-exposure (22). Bronchial asthma prevalence is increasing worldwide and substantial population of patients with asthma 28-78% in the western world report coexisting allergic rhinitis (23-25), in our study asthma and rhinitis co-existed in 569 patients (51.4%). As allergy is defined as an exaggerated immune mediated response to various allergens. Atopy is the genetic susceptibility to develop IgE antibodies in response to exposure to allergens, and is assessed by postive skin test.

Variables	Males N = 499		Females N = 607		p-value significance
	Positive = 280		Positive = 289		
	n	%	n	%	
Nationality					
Qatari	168	60.0	205	70.9	0.018
Non Qatari	112	40.0	74	29.1	
Age (in years)					
<15	30	10.1	11	3.8	0.008
15-24	77	27.5	68	23.6	
25-34	65	23.2	86	29.7	
35-44	55	19.6	67	23.1	
>45	53	18.6	57	19.8	
IgE Levels					
<241 IU/ml	62	22.1	72	24.9	NS
>241 IU/ml	150	53.6	174	60.2	
Respiratory Condition					
Asthma	72	29.8	83	32.7	NS
Allergic Rhinitis	208	86.0	206	81.1	NS
Skin Allergy					
Eczema, pruritus, urticaria	17	7.0	23	9.1	NS

Table 1 : Characteristics of the population by gender (N = 1106).
NS = Not-significant

Onset years	Skin test positive n = 569		Skin test negative n = 537	
	Frequency	%	Frequency	%
< 10 years	318	55.9	81	15.1
10 - 20 years	148	26.0	134	24.9
> 20 years	103	18.1	322	60.0

Table 2 : Distribution of 1106 asthmatic patients according to skin prick test reactivity and age of onset.

Country	Reference	Skin test positive (%)	Skin test negative (%)
Tristan da Cunha	33	89	11
United Kingdom	13	38	40
Brisbane	12	34	12.5
Kuwait	17; 18	47	10
United Arab Emirates	9; 19	44	13.8
Qatar	present study	51.4	16.4

Table 3 : Positive family history of asthma in parents or first-degree relatives

Asthma and allergic disease are recognized to have increased worldwide (2-8) in association with what is usually referred to as "Westernization" which is probably greater affluence of society (1-2, 9-10, 15-19). The present study revealed that there seems to be a trend for the number of skin test positive patients to decrease as the age of onset of symptoms is increased. The opposite occurred in skin negative patients (table 2);. This finding is consistent with other reported study in UAE (9), in UK (13) and in Kuwait (17, 18).

Many types of allergens may be present in the environment and may lead to sensitization and respiratory allergy (9-15-19). Common indoor allergens include house dust mites, animal danders, and cockroach aller-

gens (25). Skin test reactivity is the measure used routinely in clinical practice in Qatar at present to detect atopy in patients with asthma and rhinitis. It is an important diagnostic test to determine triggers of asthma and rhinitis and continues to be the method of choice when the skin is suitable for testing. Compared to *in vitro* tests it is easy, fast, cost effective-sensitive, and multiple allergens can be tested at the same time and result is known in 15 minutes. In the present study we showed the prevalence of house dust mites (43.2%) which is comparable to other countries (14, 22-27), and not surprising in Qatar environment, (hot and humid during summer month, relatively humid throughout the year), where almost every house is fitted with carpets and air conditions with reduced natural ventilation.

Allergen	Males N = 499		Females N = 499		p-value Significance
	Positive = 280		Positive = 280		
	n	%	n	%	
Pollens					
Composite	2	0.4	13	2.1	0.016
Mugwort	4	0.8	15	2.5	0.037
Chenopod	24	4.8	44	7.2	NS
Sorrel	1	0.2	9	1.5	0.027
Weeds Mix	2	0.4	7	1.2	NS
Ragweed	2	0.4	4	0.7	NS
Grasses					
Grass 5	15	3.0	20	3.3	NS
Grass 12	32	6.4	30	4.9	NS
Cereal	17	3.4	25	4.1	NS
Trees					
Fagaceae	1	0.2	4	0.7	NS
Betulaceae	3	0.6	10	1.6	NS
Mulberry Wht	7	1.4	9	1.5	NS
Cypress	2	0.4	3	0.5	NS
Oleaceae	8	1.6	8	1.3	NS
Salicaceae	3	0.6	3	0.5	NS
Trees Mix	7	1.4	17	2.8	NS
Mites					
D. Farinae	106	21.2	92	15.2	0.009
D. Pteron	109	21.8	105	17.3	0.066
Storage Mites	18	3.6	18	3.0	NS
Insects					
Cockroach	50	10.0	36	5.9	0.013

Table 4 : Sensitivity to aeroallergens , pollens, grasses and trees by gender.
NS = Not-significant.

The second most frequent allergen in our study is cockroach, which is an important source of respiratory allergy (26-27). Socioeconomic status and race are independent risk factors in cockroach allergen exposure both in house and school settings (26-28), with a clear dose response relationship between cockroach

allergens exposure and sensitization in children with asthma. Our patients were tested to German cockroach (*Blattella Germanica*) and 32.2% of patients tested had a positive SPT to cockroach regardless of nationality or sex, (table 4). Although many homes show no visual evidence of cockroach infestation they have

Variables			Males n = 607		p-value significance
			Females n = 289		
				%	
Molds and Yeast					
Alternaria	19	3.8	13	2.1	NS
Cladosporium	6	1.2	7	1.2	NS
Pencillium	6	1.2	11	1.8	NS
Botrytis	6	1.2	5	0.8	NS
Mucor	1	0.2	4	0.7	NS
Rhizopus nig	3	0.6	5	0.8	NS
Stemphylium	18	3.6	9	1.5	0.030
Chaetomium	9	1.8	8	1.3	0.625
Pusarium	6	1.2	6	1.0	NS
Pullularia	20	4.0	16	2.6	NS
Epicoccum	8	1.6	10	1.6	NS
Helminthosporium	28	5.6	18	3.0	0.034
Merulius	6	1.2	3	0.5	NS
Trichithecium	4	0.8	5	0.8	NS
Yeast mix	8	1.6	6	1.0	NS
Smut mix	1	0.2	3	0.5	NS
Aspergillus	6	1.2	8	1.3	NS
Others					
DERMO	8	1.6	11	1.6	NS

Table 5 : Sensitivity to Aeroallergens (Molds and Yeast) by gender.
NS = Not-significant.

	Relative Risk (RR)	Confidence Interval	p value significance
Allergic diseases			
Asthma 2.51	1.92 – 3.29	P < 0.01	p < 0.001
Allergic rhinitis	3.58	2.65 – 4.83	
Atopy 3.83	3.11 – 8.55	p < 0.0001	
Radioallergosorbent test			
Pollen 3.10	2.21 – 4.27	p < 0.001	p < 0.01
Mite 2.61	2.02 – 3.29	p < 0.01	
Cockroaches	1.82	1.32 – 2.47	

Table 6 : The association between elevated IgE level (>241 IU/ml) and allergic diseases atopy and SPT in studied subjects.

been found to have significant evidence cockroach allergens (27-28).

A comparison of skin prick test results from different countries showed different prevalence rates such as in United Arab Emirates (9-19), (61.6%) , Kuwait (80%) (17-18), Saudi Arabia (53%) (15), and UK (66%) (13), Australia (ranged between 31.6%-77.6%) (8, 10, 12) have an extremely high incidence of pollen hypersensitivity. A low incidence of pollen hypersensitivity has been reported from Singapore (1%) (29) and France (12.7%) (4). The present study finding is consistent with other reported studies in Saudi Arabia (15), in Kuwait (17-18) and in other parts of the world such as in Australia (12), in UK (13), in France (4) and in Spain (30).

Our findings support the hypothesis that asthma is a multifactorial disease related to both environmental (2, 7-20, 31) and genetics factors (16, 17, 20-32). The relative contribution of genetic and environmental factors are not yet clear. However, our results of a higher prevalence of family history with allergic respiratory diseases strongly supports the hypothesis that they are inherited (16, 17, 30-32). The association of asthma, allergic rhinitis and eczema in the same patient has been reported (16, 17, 20-32), but the exact mode of genetic inheritance or transmission for asthma is still unknown. Although the reported from Tristan da Cunha (33), our skin test positive Qatari patients had a positive family history incidence of less than half that reported in skin test positive asthmatic in this study.

In conclusion, the frequency of indoor and outdoor allergens in state of Qatar, based on skin prick test study showed the dominance of house dust mites, pollen, grasses which are more or less similar to other countries with similar and even with different climate.

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