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Sensitization to Allergens among Patients with Allergic Rhinitis in Warm Dry Climates

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Objective: To investigate sensitization to aeroallergens, animal dander, house dust mite (HDM) and mould in adult patients with allergic rhinitis without previous history of treatment in warm dry climates.

Design: Prospective study.

Setting: ENT clinic Alflah International Hospital, Riyadh, Saudi Arabia.

Method: Sera were screened for specific IgE by using an immunoblot assay to twenty allergens namely: alder, birch, hazel, mixed grasses, rye, mugwort, plantain, oak; cat, dog, horse, guinea pig, golden hamster, rabbit; *pteronyssinus farinae, alternata*, *Penicillium*, *Cladosporium,* and *Aspergillus*.

Result: Specific IgE antibodies were detected in 29/42 (69%) of all the subjects. The sensitization rate was highest for pollen while results for other allergen groups are as follows: pollen 86/127 (66.9%), animal dander 29/127 (22.8%), HDM 11/127 (8.6%) and moulds 2/127 (1.6%). Among allergenic pollen, mixed grasses were the most common cause of sensitization 14/127 (11.0%). Sensitization rate to cat and dog danders are 12/127 (9.4%) and 10/127 (7.9%), while dander from horse 4/127 (3.1%), guinea pig 1/127 (0.8%) and golden hamster 2/127 (1.6%) caused lower rates of sensitization. *Pteronyssinus* and *farinae* are the most prevalent indoor sensitizers 4/127 (3.1%) and 7/127 (5.5%). Sensitization to mould is relatively rare 2/127 (1.6%).

Conclusion: The results show that even in warm climates, pollen, animal dander and HDM allergens may be important sensitizing allergens. Pollens of local horticultural plants are the main sensitizing allergens among these patients. The practice of greening the country seems to contribute to increased rates of allergic sensitization of persons prone to allergic rhinitis. Local environmental and genetic factors are probably involved in the pathogenesis of the disease.

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Allergic rhinitis is an inflammation of the nasal mucosa, characterized by nasal and eye discharge, itching, sneezing, watery rhinorrhea, congestion, often with coexisting asthma and sensitivity to specific allergens[1,2]. It is also considered the most common type of allergic disease seen in primary care and is the sixth leading cause of morbidity[3]. Allergic rhinitis is a hypersensitive response to allergens mediated by IgE antibodies.

Rhinitis can be allergic, non-allergic or a combination of the two types. It may be seasonal, perennial or occupational. Seasonal allergic rhinitis usually occurs at the same time each year and is called hay fever. Symptoms usually occur in spring and early summer and with the seasonal changes through contact with allergens, which are present in the environment among which, are house dust mites, animal dander and moulds. Patients with perennial allergic rhinitis are more likely to have asthma than those with seasonal allergic rhinitis[4].

Non-allergic rhinitis may be irritative, infectious, drug- induced, or vasomotor. Irritants include cold air, smoke, strong odors, alcohol vapor, air pollution, and exhaust fumes[5]. It is characterized by sporadic or persistent perennial symptoms of rhinitis that do not result from IgE-mediated immunopathologic events.

The exact pathogenesis of allergic rhinitis is not clear. IgE mediated hypersensitivity plays an important role as well as interleukins produced by activated lymphocytes. The association of rhinitis with a family history of allergy, positive IgE-specific allergens and the exacerbation or improvement of the symptoms in the presence or absence of exacerbating allergens suggests the importance of an IgE- mediated mechanism.

The aim of this study is to investigate allergic sensitization to HDM, pollen, dander and mould among adult patients with allergic rhinitis by using an immunoblot assay containing specific IgE.

METHOD

The study was approved by the hospital research ethics committee. The patients gave their informed consent and were given the results of the tests for further assessment and treatment. Blood samples were collected from 42 adult patients diagnosed with allergic rhinitis consisting of twenty-eight males and fourteen females from April 2002 to March 2005. All had no previous history of treatments. Sera were separated after coagulation for 30 minutes followed by centrifugation for 10 minutes.

The samples were investigated for IgE-antibodies specific to 20 different allergens, namely: pollen/aeroallergens (alder, birch, hazel, mixed grasses, rye, mugwort, plantain, and oak); animal dander (cat, horse, dog, guinea pig, golden hamster, and rabbit); HDM (*Dermatophagoides pteronyssinus* and *Dermatophagoides farinae)*; mould (*Alternaria alternate*, *Penicillium notatum*, *Cladosporium herbarum*, and *Aspergillus fumigatus).*

The study employed an allergen immunoblot assay (RIDA Allergy Screen, r-biopharm Germany) where allergens are bound to the surface of nitrocellulose membrane with patient serum and incubated at room temperature, and then the membrane is washed. After allergy screen, detection antibody is added and again incubated and washed. Streptavidin conjugate with alkaline phosphatase is added which binds to biotin in the test fields. The reaction is stopped by rinsing the membrane with tap water. Results were analyzed and interpreted by comparing it with positive and negative controls. Negative controls consisted of an uncoated portion of the carrier membrane while the positive control consisted of an area in the membrane impregnated with biotin-labeled bovine serum albumin (Figure 1).

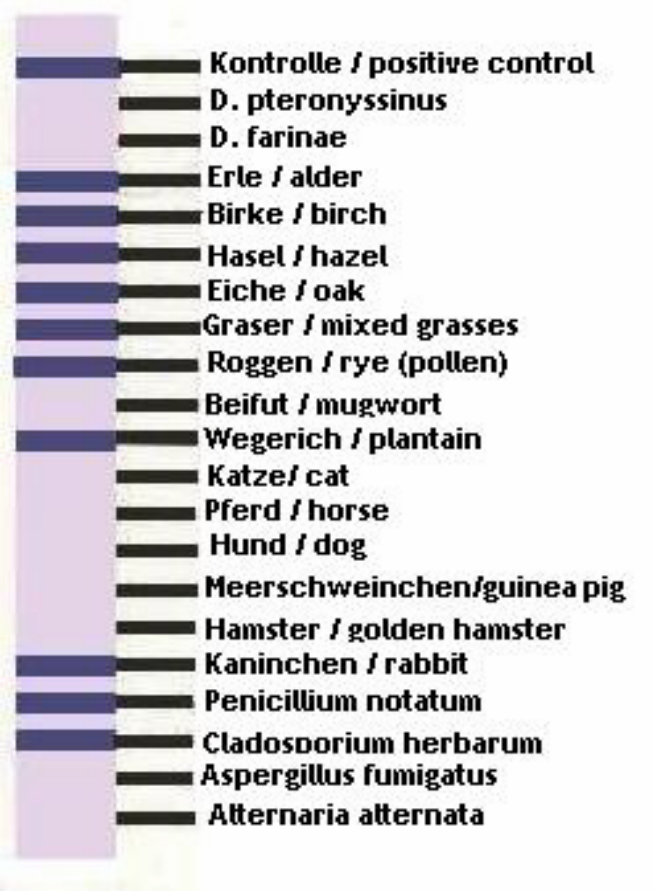

Figure 1 illustrates the results appearance on the surface of nitrocellulose membrane

Statistical Methods:

All analysis was performed using the Instat (Instat Biostatistics, Graphpad Package USA). Normal distributed data were analyzed using student t-test and values are calculated. Non-parametric tests were used when data were compared between allergens present and absent. Mann-Whitney test was also used. The two-sided p-value was applied and less then 0.05 was considered significant.

RESULT

Twenty-nine cases (69%) showed positivity to specific IgE (pollen/aeroallergens, HDM, animal dander and moulds) (Table 1). A total of 85/127 (66.9%) were sensitive to at least one pollen allergen or more–(alder 12/127 (9.4%), birch 11/127 (8.7%), hazel 10/127 (7.9%), grasses 14/127 (11.0%), rye 13/127 (10.2%), mugwort 9/127 (7.1%), plantain 5/127 (3.9%), oak 11/127 (8.7%). Total sensitization to animal dander was 29/127 (22.8%) - (cat 12/127 (9.4%), horse 4/127 (3.1%), dog 10/127 (7.9%), guinea pig 1/127 (0.8%), golden hamster 2/127 (1.6%) and rabbit 0%). House dust mite sensitization occurred in 11/127 (8.6%) (*Dermatophagoides farinae* 7/127 (5.5%), *Dermatophagoides pteronyssinus* 4/127 (3.1%). A minor fraction 2/127 (1.6%) of the subjects were positive to mould allergens, with equal rates between *aspergillus fumigatus* and *Cladosporium herbarium* 1/127 (0.8%). None was sensitive to *Alternaria alternate* and *Penicillium notatum* (Table 2). Table 3 shows the most frequent combination of allergen antibodies in patients who developed one or more antibodies.

Table 1. The relationship between absence and presence of allergen specific IgE in rhinitis patients

Parameters	Number	Allergen Absent	Allergen Present	P value
Patients	42	13 (31.0%)	29 (69.0%)	< 0.005
Male	28	06 (21.4%)	22 (78.6%)	< 0.005
Female	14	08 (57.1%)	06 (42.9%)	0.5

P value <0.05 was considered significant different

Table 2. Distribution of allergen antibodies in rhinitis patients

Allergen (antigen system)	Allergen Antibodies No.	Allergen Antibodies (%)	Antibodies System (%)
A. Pollens (Aeroallergens)			66.9
Alder	12	9.4	
Birch	11	8.7	
Hazel	10	7.9	
Mixed Grasses	14	11.0	
Rye	13	10.2	
Mugwort	9	7.1	
Plantain	5	3.9	
Oak	11	8.7	
B. Animal epithelia dander			22.8
Cat	12	9.4	
Horse	4	3.1	
Dog	10	7.9	
Guinea pig	1	0.8	
Golden Hamster	2	1.6	
Rabbit	-	-	
C. House dust Mites			8.6
Derm. *pteronyssinus*	4	3.1	
Derm. *farinae*	7	5.5	
D. Moulds			1.6
Alternaria alternate	-	-	
Penicillium notatum	-	-	
Cladosporium hebarum	1	0.8	
Aspergillus fumigatus	1	0.8	
Total	127	100	

Table 3. Patients with one or multiple allergen antibodies (developed)

NO. OF ALLERGEN	NO. OF PATIENTS	IMMUNIZED

ANTIBODIES DEVELOPED	& PERCENTAGE	PATIENTS PERCENTAGE
1	07 (16.7%)	24.2 %
2	02 (4.8%)	06.9%
3	04 (9.5%)	13.8 %
4	03 (7.1%)	10.3 %
5	03 (7.1%)	10.3 %
6	03 (7.1%)	10.3 %
7	01 (2.4%)	03.5 %
8	04 (9.5%)	13.8 %
9	01 (2.4%)	03.5%
11	01 (2.4%)	03.5 %
Total	69%	100%

In this study, subsets of patients showed a variety of (overlapped) combined sensitization to two or more types of allergens. A subset composed of 1/42 (2.4%) of the combined sensitization to both moulds and pollen; another subset showed combined sensitization to both moulds and animal dander 1/42 (2.4%); while the same percentage showed common sensitization to both pollen and house dust mites 4/42 (9.5%). The largest subsets showed sensitization to both dander and pollen 5/42 (11.9%) and pollen and animal dander 2/42 (4.8%). A single subset of patients 2/42 (4.8%) displayed sensitization to three forms of allergens–pollen, animal dander and house dust mites.

DISCUSSION

This study clearly suggests that pollen/aeroallergens constitute the most important group of sensitizing allergens in patients with allergic rhinitis in this region with as many as 85/127 66.9% of all positive cases sensitized to at least one pollen. In a related study, grass pollen was found to be the major allergens[6]. In Kuwait, higher sensitization rates were seen among pollen belonging to plants, which were imported from other countries for shading purposes or for binding sand, like *Chenopedium* and *Bermuda* grass[7]. According to the all India Coordinated Project on aeroallergens and human health, major allergens in India vary from place to place and the main agents implicated are pollen grains, fungal spores, dust mites and animal epithelial dander[8]. In most European and North American countries allergens with the highest sensitization rates among patients with nasal symptoms were also pollen/aeroallergens followed by house dust mites and cat dander. Ragweed pollen is a major provocative factor for allergic rhinitis among North American patients[9]. HDM were reported to have the highest rate of sensitization among patients with allergic rhinitis in Thailand, Singapore and in Taiwan especially among asthmatic patients[10, 11, 12]. Pumhirum et al reported that *Dermatophagoides pteronyssinus* and *Blomia tropicalis* were the most common species of mites in the houses of allergenic patients in Thailand (52.1%)[10]. In the present study, it accounted for 11/127 (8.6%) only. This difference was expected since mites require high humidity and moderate temperatures to thrive. This result shows, that, animal dander 29/127 (22.8%) and HDM 11/127 (8.6%) pose a significant, though less important source of allergen than mould 2/127 (1.6%). Pollen/aeroallergens is the leading cause of sensitization 85/127 (66.9%), attributable in part to the all too common utilization of plants in urban areas (like Riyadh), which are purposely cultivated for greening purposes. In addition, windy conditions during summer cause an increase in allergic rhinitis cases. An increase in pet ownership in Saudi Arabia in recent years may contribute to an increased number of allergies to animal dander allergies.

Saudi Arabia presents a unique set of conditions, which have not been explored adequately in as far as how they affect the prevalence of allergic rhinitis in the local population. This is obviously

reflected in the paucity of published studies on this disease and its causative factors. In most studies from Saudi Arabia, the prevalence of seasonal allergic rhinitis is significantly higher than perennial allergic rhinitis, and range from 4.5% to 38.3%[13]. The prevalence of allergic rhinitis is lower in children than in adults and is much higher in the more industrialized countries.

Pet ownership is not popular in Saudi Arabia and detailed studies on animal dander sensitivity are lacking. Pet ownership is undoubtedly a more common practice in other parts of the non-Muslim world, such as in Europe and America, where more and more people are choosing a solitary existence, accompanied only by a pet animal at home.

Allergen calendars could be a helpful guide in determining probable provocative factors among allergic rhinitis patients presenting with a history of sensitization. Spring heralds an epidemiologic peak in the number of cases yearly.

CONCLUSION

In this study, pollen are the main sensitizing allergens among patients with allergic rhinitis in this region, along with other known indoor allergens which may play a role in the pathogenesis of allergic respiratory diseases and should therefore be considered important factors in the management of patients affected in regions presenting with a generally warm dry climate most of the year. Subtle changes in social practices, like pet ownership, increasing mobilization and introduction of new potentially allergen-producing plant species in urban areas for greening are likely to become increasingly important in the causation of this allergic disease. However, there are no previous studies in the same region to compare the result of this study with. The result of this study is mostly consistent with the result of other studies in other parts of the world, with some variations due to differences in environmental conditions and social practices.

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