

A COMPARATIVE STUDY OF IMMEDIATE SKIN TEST REACTIVITY TO INHALANT ALLERGENS IN ASTHMATIC CHILDREN OF TWO DIFFERENT REGIONS IN SAUDI ARABIA

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تم مقارنة تفاعلات اختبار الجلد لمستأرجات الاستنشاق المختلفة لدى أطفال ريوين من منطقتين مختلفتين في المملكة العربية السعودية. اخترنا لذلك مئة وعشرين طفلاً من كل من المنطقتين الغربية والوسطى يمثلون ملامح بيئية مختلفة. تم تحليل تفاعل اختبار الوخز لأربع وعشرين مستأرجاً ومقارنتها. أظهر واحد وسبعون مريضاً (٢, ٥٩٪) من الرياض (المنطقة الوسطى)، تفاعلات جلدية إيجابية لمستأرج واحد أو أكثر، بينما أبدى سبع وثمانون مريضاً (٥, ٧٢٪) من مكة المكرمة (المنطقة الغربية)، تفاعلات إيجابية لمستأرجات مختلفة. أظهر توزيع حساسية اختبار الجلد فروقاً واضحة بين المجموعتين، كان أبرزها التفاعلات لسوس غبار المنازل من نوع (D. Farinae) الذي كان مسؤولاً عن نسبة ٣, ٥٦٪، وللمستأرجات الفطرية (١, ٣١٪) لدى الربويين في المنطقة الغربية، بينما كانت التفاعلات للمستأرجات نفسها في المنطقة الوسطى ١٠٪ و ٥, ٨٪ على التوالي. كما شوهدت اختلافات ملحوظة فيما يتعلق بمستأرجات غبار الطلع بلغت نسبتها ٣, ٩٪ في المنطقة الوسطى و ٤, ١٥٪ في المنطقة الغربية. تشير الدراسة إلى وجود أنماط مختلفة للمستأرجات في المنطقتين كما تشير إلى العوامل المناخية والبيئية وتأثيرها على تحسيس من لديهم استعداد للتأثر.

The skin test reactivities to various inhalant allergens in asthmatic children from two different regions in Saudi Arabia were compared. One hundred-twenty subjects each from the Central and Western regions, representing different environmental features, were selected. Prick test reactivity to 24 common allergens were analyzed and compared. Seventy-one (59.2%) patients from Riyadh (Central region) showed positive skin reactions to one or more allergens, while 87 (72.5%) reacted positively to different allergens from Makkah (Western region). The distribution of skin test sensitivity revealed striking differences in the two groups. The most prominent were reactions to the house dust mite (*D. farinae*) which amounted to 56.3% and to fungal allergens, 31.1% in asthmatics from the Western region, while reactions to the same allergens in subjects from the Central region were 10% and 5.8%, respectively. Similarly, marked variations were noted with pollen grain allergens with 9.3% in Central region and 15.4% in the Western region. The study indicates the presence of different allergen profiles in the two regions and suggests the influence of climatic and environmental factors and their impact on sensitization of susceptible subjects.

Bronchial asthma in children is a common disease in Saudi Arabia with up to 11.5% children, nationally, having wheeze [1,2]. The disease

varies from region to region and extrinsic factors are considered to be important in the sensitization of susceptible individuals and in the elicitation of their symptoms [3,4]. It is well documented that environmental factors are more significant than genetic factors in development of allergic disease [5]. Based on this, attempts have been made to prevent the onset of disease by avoidance of provoking factors [6]. This depends on knowledge about the prevalent allergens in different localities as well as their identification in subjects. Many diagnostic probes are available. However, the

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skin prick test method is preferred because of its ease of performance, high degree of reproducibility, and better correlation with in vitro measurements [7,8].

The present investigation was undertaken to determine the pattern of immediate type hypersensitivity reaction in asthmatic children to a common panel of inhalant allergens in two different geographically and climatologically regions of Saudi Arabia.

Material and Methods

Subjects

One hundred-twenty children, each from Riyadh (Central region) and Makkah Al Mukkaramah (Western region) were included in the study. These were asthmatic children attending the Pediatric Allergy Clinic at King Khalid University Hospital (KKUH), Riyadh and the Pediatric Clinic at Umm-Al-Qurah University Health Center, Makkah. Riyadh, the capital city of Saudi Arabia, is situated in the middle of desert with dry and hot weather. Makkah, an ancient city, is situated within 100 km from the coastal city of Jeddah and from the Red Sea with comparatively humid and hot weather. Only children between 6 to 13 years of age were included in the study. Each child was earlier diagnosed by a physician as suffering from bronchial asthma following a full history and clinical examination.

SPT Allergens

All patients were skin prick tested (SPT) with a set of inhalant allergens (24) obtained from Allergologisk Laboratorium (ALK), Denmark. The allergen extracts were grouped into pollen allergens including tree, grass, and weeds; fungal spore allergens including a range of species identified from spore traps in the region and indoor allergen group including insects, house dust mite (*D. farinae*) and animal danders (dog hair and cat fur), and cotton flock (Table 1). Materials for skin testing were selected as representing the most common regional allergens from our studies in the region [9-12]. All SPT was conducted using standardized special purity (SQ) materials where possible. A small number of samples were also purchased from Greer Laboratories, USA. A positive control with histamine (1 mg/ml) dihydrogen phosphate and a

TABLE 1. List of SPT allergens with quality and concentration.

	Species	Common name	Concentration (W/V)
Indoor	Cladosporium herbarium		1:20
	Cat fur SQ**		10 HEP*
	Dog hair SQ**		10 HEP*
	Dermatophagoides farinae SQ**		10 HEP*
	Cotton flock		1:20
	Fungi	Alternaria alternata	
Cladosporium herbarium			1:20
Rhizopus nigricans			1:20
Phoma herbarum			1:20
Ulocladium chartarum			1:20
Aspergillus fumigatus			1:20
Aspergillus niger			1:20
Pollen		Acacia SP	
	Chenopodium album	Lamb's quarter	1:100
	Plantago major		1:100
	Artemisia vulgaris	Mugwort	1:100
	Salix caprea	Willow	1:100
	Hordeum sativum	Barley	1:100
	Pragmites communis	Reed	1:100
	Zea mays	Corn	1:100
	Cynodon dactylon	Bermuda grass	1:100
	Poa Pratensis	Rapgrass SQ**	10 HEP*
	Lolium perenne	Ryegrass SQ**	10 HEP*
	Phleum pratense	Timothy SQ**	10 HEP*

* HEP indicates in vivo histamine-related standard.

** SQ indicates special purity.

negative control with glycerin saline were included in the test panel.

Method

A standard SPT method was used where a drop of the allergen solution was applied on the forearm and the skin pricked through the drop with a lancet obtained from B-D, microlance. Excess solution was then blotted off and results recorded after 15 minutes. The test was considered positive when the wheal diameter measured 3 mm or more. For the purposes of comparison, results were graded according to the wheal diameter into negative (<3 mm); positive, mild (3 mm); moderate (3-5 mm); and strong (> 5 mm).

Forty-eight hours prior to skin testing, patients discontinued antihistamines and those on long-term corticosteroid therapy were excluded.

Results

Seventy-one (59.2%) of 120 asthmatic children from the Central region (Riyadh) and 87 (72.5%) of 120 patients from the Western region (Makkah) showed positive skin test reactions to one or more allergens (Table 2).

The mean percentage and range of positive skin reactions to various groups of allergens is shown in Table 3.

Skin reactions to various indoor allergens for both patient groups are shown in Figure 1. Asthmatic children from Makkah showed frequent positive reactions to *D. farinae* followed by cat fur, cotton flock, cockroach, and dog hair.

Figure 2 shows the distribution of reactions to seven different fungal spore allergens. Asthmatics (31.3%) from the Western region showed positive sensitivity compared to 5.8% from the Central region.

Reactions to 12 pollen grain allergens are shown in Figure 3. More children reacted to *Lolium perenne* (Rye grass) and *Cynodon dactylon* (Bermuda grass) in both groups. Reactions to *Acacia*, *Zea mays* (corn), and *Artemisia vulgaris* (Mugwort) were more prominent in asthmatics from the Makkah region.

Discussion

It is well documented that IgE-mediated diseases involve a variety of mechanisms, some of which have a genetic basis [6]. However, the onset of clinical symptoms are due to interaction of susceptible individuals with environmental factors. Identification of these factors is necessary to allow the development of methods to prevent allergies.

The interaction and influence of environmental factors is well demonstrated in this study. The total number of positive skin responses was higher in patients from Makkah (Western region) compared to Riyadh (Central region). This confirms the earlier observation that the prevalence of asthma and rhinitis is higher in the Western region of Saudi Arabia. Striking differences were observed in skin reactions to fungal spores, pollen grain allergens and to the house dust mite, *Dermatophagoides farinae*. *D. farinae* was the most important indoor allergen in patients in the Western region while it played a less important role in

TABLE 2. Comparison of overall positive reactions to various allergen groups in Riyadh and Makkah regions.

	Riyadh	Makkah
Total patients tested	20	120
No. of positive patients	71	87
% of positive patients	59	73

TABLE 3. Mean percentage and range of positive skin reactions* to various groups of allergens in asthmatic children in Riyadh and Makkah.

	Riyadh (Range) (%) (%)	Makkah (Range) (%) (%)
Indoor allergens group R = 7** M = 5	32.6 (8.4-71.8)	43.9 (28.7-56.3)
Fungal allergens group R = 7 M = 7	5.8 (1.4-15.4)	31.3 (10.3-40.2)
Pollen allergens group R = 13 M = 17	9.3 (4.2-25.4)	15.4 (8.0-29.9)

* Percentages of positive reactions for various allergen groups are based on total positive reactions and not on the total number of patients tested.

** R = Riyadh, M = Makkah; number of allergens for each group tested.

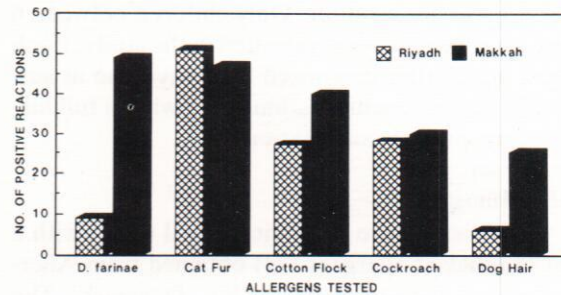


FIGURE 1. Positive skin reactions to various indoor allergens in asthmatic children in Riyadh and Makkah regions.

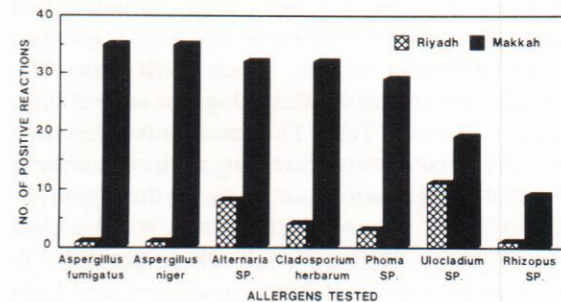


FIGURE 2. Positive skin reactions to various fungal allergens in asthmatic children in Riyadh and Makkah regions.

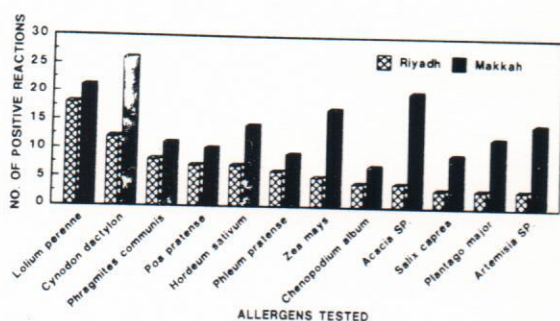


FIGURE 3. Positive skin reactions to various pollen allergens in asthmatic children in Riyadh and Makkah regions.

patients in the Central region. Sensitivity to cat fur was prominent in patients in the Riyadh region and was the second important allergen in patients from Makkah. The response to cat fur allergens was not paralleled by positive history of contact with domestic cats as the majority of patients denied direct contact with cats. Reactions to cockroach allergens and cotton flock were observed in both localities. It is worth mentioning that cockroach sensitivity is increasingly encountered in our patients and may turn out to be an important etiologic agent in causing perennial symptoms [13]. This prompted us to prepare a local extract for comparison with the commercially available cockroach allergens. The study is in progress and will be subject to subsequent communication.

On the other hand, skin reactions to fungal spore allergens showed major variations in two regions.

More patients reacted to fungal allergens from the Western region. Patients mostly reacted to *Aspergillus* species, *Alternaria*, *Cladosporium*, *Phoma* as well as to *Ulocladium* and *Rhizopus*. In the Central region asthmatic children reacted far less to fungal spore allergens. The prominent reactions were to *Ulocladium* and *Alternaria*. It is our impression, from previous aerobiological studies and analysis of dust from patients' homes, that fungal spores may be important outdoor as well as indoor allergens and may also be responsible for perennial symptoms. A comprehensive study on fungal allergy using locally prepared extracts is currently underway and preliminary results are encouraging.

Skin reactions to pollen allergens were also found to be more frequent in patients from the Western region. Asthmatic children frequently reacted to *Cynodon dactylon* (Bermuda grass), *Lolium perenne* (Rye grass), *Acacia*, *Zea mays* (Corn), and *Artemisia vulgaris* (Mugwort). In the

Central region, more reactions to *Lolium perenne* (Rye grass) and *Cynodon dactylon* (Bermuda grass) were observed. Skin reactions to *Acacia*, *Zea mays* (Corn), and *Artemisia vulgaris* (Mugwort) were far less frequent.

In conclusion, it appears that aerobiological studies are important prerequisites for proper management and prevention of allergic disease. The Kingdom of Saudi Arabia is a large country with different environmental features. It seems important to perform similar studies in other regions in order to set up a national allergen profile. This will be of practical value for the management and prevention of allergic diseases. The study also indicates that a high proportion of allergic individuals have IgE antibodies against the allergens tested and they may be "at risk" to manifest symptoms if re-exposed to these allergens.

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