

Point prevalence of allergic rhinitis among Saudi children*

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SUMMARY

Background: Study of allergic rhinitis (AR) has only recently started in Saudi Arabia. No estimate of the actual percent of the population suffering from AR, especially children, is available.

Objective: To study the prevalence of AR in children in the Kingdom of Saudi Arabia, the association with hearing impairment (HI) and bronchial asthma.

Methods: An epidemiological survey was carried out using a modified "International study of asthma and allergies in childhood" (ISAAC) questionnaire for rhinitis phase1. The children with allergic history were subjected to allergy work up.

Ten thousand children were surveyed and the clinical history of rhinitis (sneezing, rhinorrhea, irritation, nasal blockage) during the past 12 months was recorded. In total, 9540 children with complete data were interviewed. Demographic characteristics including age, sex, parents' relation, and family history were noted and an Ear, Nose and Throat (ENT) examination and hearing screening was performed.

Results: We identified 2529 children with rhinitis (prevalence 26.51%), 25.66% of them with physician diagnosed asthma. Laboratory tests were performed on blood samples from 304 children. A skin prick test with relevant allergens was performed on those aged 6 to 15 years: 61.8% had positive results to one or more allergens, compared to 23.75% in a non-rhinitis control group. HI was found in 450 (17.8%) of the rhinitis group compared to 791 (12.7%) among the non-rhinitis group.

Conclusions: Compared with previous studies in Saudi Arabia, this survey showed higher rates of allergic disease. HI was also found to be higher among rhinitis children. This could be attributed to environmental, social or genetic factors.

Key words: allergic rhinitis, prevalence, carpet, consanguinity, Saudi Arabia, hearing impairment.

INTRODUCTION

The Kingdom of Saudi Arabia is a large country with a population of around 20 millions inhabitants. Administratively it is divided into 4 main provinces, which differ geographically and environmentally- the Central province is in the middle of the desert with dry environment, while most of the Eastern and Western provinces have a coastal humid environment. On the other hand, the Southern province is mainly mountainous and agricultural. A large number of plants have been imported to the Kingdom recently.

Allergic rhinitis is the most common of allergic disorders affecting 10 - 45% of the world population (Sibbald and Rink, 1990). It is an inflammatory disorder induced by an IgE mediated inflammation following allergen exposure of the mucous membrane lining the nose, characterized by recurrent or chronic nasal symptoms of sneezing, runny nose, itching and

nasal blockage. The condition may be associated with conjunctivitis, dermatitis, and asthma. It usually varies seasonally and is episodic, although some forms of allergic rhinitis occur all year round (Sibbald and Rink, 1991). Many risk factors were implicated: genetic, environmental, social, domestic pets in the house and geography (Wright et al., 1994).

There is growing evidence that allergic diseases, especially rhinitis, are becoming increasingly common (Bellanti and Wallerstedt, 2000).

The aims of this study are to report on the prevalence of allergic rhinitis in children from the four main provinces of the kingdom of Saudi Arabia, the association with asthma, the common allergen and the effect of environmental changes in the country and the distribution in the various geographical areas.

MATERIALS AND METHODS

This study was conducted as part of a general survey of hearing impairment (HI). Two forms were used: the (WHO / PDHI) World Health Organization (1992) questionnaire for HI surveys and an internationally designed questionnaire (core questionnaire for rhinitis) phase 1 from ISAAC (Auckland and Munster, 1993). The 6 questionnaires on rhinitis were completed by all age groups surveyed for HI and were not restricted to a specific age group as suggested by ISAAC. Two more items were added, i.e. the province where the children reside for the past year, and the parents' relationship (consanguinity) and family history of allergic diseases. The core questionnaires on asthma and eczema including the video one were not completed in this survey. The history of wheezing, breathlessness, night dry cough, medication prescribed by the physician for treatment of asthma diagnosed by doctors, history of early childhood recurrent inflammation of the skin with scratching and appearance of rashes were noted. Interviews were held with 9540 children who had complete data together with one or both parents about their symptoms. Social workers, nurses and research assistants were among the team for interviews and filling out the questionnaire with the help of parents. Demographic characteristics including age, sex, parents relation, family history, type of housing, carpet, pet in the house and smoking, and provoking factors such as dust, moulds, perfumes, fumes, change in air temperature, emotion and attack of cold or infection and food type were recorded. Physical examination of all children was conducted by an Otolaryngologist and a Pediatric Physician. Skin prick tests were performed using a panel of allergens (Zakzouk and Gad-El Rab, 1996) (Table 1) selected according to local data from aerobiological studies and dust sample analysis in Saudi

Table 1. Panel of various allergens used in skin testing.

Species		
Domestic (indoor)	Fungi	Ingestants
House dust mix	Altermaria altermaria	Egg protein
H.D. mite (farinae)	Cladosporium herbarum	Mild protein
Cockroach	Ulocladium chartarum	Wheat
Cat	Aspergillus fumigatus	Tomato
Cotton flock		
Feather mix		
Sheep wool		
Species	Common Name	
Pollen		
Cynodon dactylon	Bermuda grass	
Lolium perene	Rye grass	
Chenopodium album	Fat hen	
Phlium pratensis	Timothy grass	
Phragmites communis	Reed	
Hordium sativum	Barley	
Rumex crispus	Dock Dock	
Mixed grasses		
Iris germanica	Orris root	

Arabia. Drops of allergen were spaced along the forearm and the skin pricked with a fine blood lancet. Reactions were read at 10 - 15 min and the wheal diameter was recorded. A positive control with histamine hydrochloride (1 mg/ml) and a negative control using saline were included for every patient. A positive reaction was determined as a wheal of 3 mm or more in diameter greater than the negative control. The tests were carried out in a hospital by a well trained technician under the supervision of a medically qualified immunologist, and emergency management was available should anaphylaxis occur. A controlled group of 80 children aged 6 - 15 without allergic rhinitis was skin tested. IgE estimation by a two step sandwich assay (Boehringer - Mannheim ES 300 analyser), and complete blood counts were carried out for clinically positive cases who managed to report to the hospital for investigation. The data were analyzed using Epi Info computer software.

RESULTS

In total, 9540 children entered the study. They were divided into four groups according to age. Group 1: up to 4 years, Group 2: between 4 and 8, Group 3: between 8-12, and Group 4: between 12-15 years. The characteristic and distribution of children are shown in Tables 2 and 3.

Of these children, 4189 were male (44%) and 5351 (56%) were female, and 2529 were found with rhinitis (26.51% of total) and 649 (25.66% of the rhinitis group), had asthma as well.

The presence of eczema (dermatitis) was noted in the past 12 months in 309 (12.22%) of the rhinitis children surveyed, while 240 (9.5%) had conjunctivitis (hay fever). Only 374 (14.79%) of the children with clinically diagnosed allergic rhinitis managed to come to the hospital to be studied further. Skin prick tests with relevant allergens (Table 1) was performed on 304 children aged 6 to 15 years. Of these, 188 (61.8%) had a positive result to one or more allergens and 116 (38.2%) were negative. A positive family history of allergic disease was given by 139 (73.9%) children of the positive skin test group. The control group without rhinitis showed 23.75% positive skin test. The most common allergens were house dust, cat danders and pollen, mostly Bermuda grass.

Total IgE was measured in some randomly selected children. Serum IgE > 200 IU/L was found in 180 (48%). Eosinophilia of more than 10% was noted in 82 (27%).

Hearing impairment was found among 450 (17.8%) children of the rhinitis group while in the non allergic children it was 791 (12.7%) ($p < 0.001$).

Table 3. Characteristics of allergic children.

Allergic children	No.	% Of total	% Of total those with rhinitis
Allergic rhinitis	2529	26.51	
Athma + Allergic rhinitis	649	6.8	25.66
History of dermatitis	309	3.24	12.22
Conjunctivitis	240	2.52	9.5

Table 2. Details of subjects about age, sex, allergic status with percentage.

Groups	Number	Male	Allergic	Female	Allergic	Total Allergic	%
(1) up to 4 years	2054	1108	294	946	226	520	25.32
(2) > 4- 8 years	3431	1749	540	1682	410	950	27.68
(3) > 8-12 years	3615	1251	538	2364	359	897	24.81
(4) > 12-15 years	440	81	69	359	93	162	36.82
TOTAL	9540	4189	1441	5351	1088	2529	26.51

DISCUSSION

Allergic rhinitis represents a global health problem affecting 10 to 45% of the world population (Sibbald and Rink, 1990). Allergic diseases in Saudi Arabia are increasing according to recent epidemiological and aerobiological studies (Al Frayh et al., 1989; Hasnain et al., 1989; Al Frayh et al., 2001). The rapidly changing nature of the Saudi environment in the form of agricultural and irrigation development, greening of the streets, imported flora and many plant species have pollens that are allergic in nature. Fungal spores and airborne pollens of grasses, weeds and trees have been detected using a Burkard trap (Burkard manufacturing co, Rickmansworth, Hertfordshire, England). Air pollution and smoking exposure may damage the respiratory epithelial cells and thus predispose to rhinitis and asthma. The large number of cars with no emission controls increases the level of pollution. The living habits of the Saudi population have changed recently and with the increase of the fast food shops, the eating habits have also changed, both in consumption and diversity of foods rich in proteins. Diet is a major source of exposure to allergens in infancy (Bahna, 1992). Furniture, mostly imported, is rich in synthetic organic contents. These factors may play an important role in the increased number of patients with allergic diseases. Careful attention to food allergies and the presence of household allergens during infancy and early childhood may limit potential sensitizations. It was reported by Al Frayh et al. (2001) that allergic diseases in Saudi Arabia have increased from 20% to 25% during the period 1987 to 1995, and it was attributed to environmental factors. It appears that the continuous change in life-style such as wall to wall carpeting and gardening along with the above-noted factors may have contributed to the increasing prevalence of allergy in the country. Geography may play a role as the prevalence of allergic disease was found to be high among children from the Southern (32.66%) and Eastern provinces (29.21%) while it is less in the Central and Western provinces (24.82% - 26.09%, respectively) (Table 4). This increase in prevalence may be attributed to environmental and

social factors, including exposure to environmental tobacco smoke, birth weight, breast-feeding, and household size. It may be also explained by the hygiene hypothesis which suggests that the lack of microbial stimulation of sufficient intensity early in life may affect the maturation of the immune system, leading to the predominance of a biased T helper (Th2) cell subtype in genetically susceptible individuals. This, in turn, results in the development of asthma and its associated phenotypes. So, environmental exposure to Th1-polarizing microbial products can modulate the allergic response. Genetic risk factors have been implicated in the development of allergic rhinitis with positive family history and the occurrence of the disease is more among children of consanguineous parents and relatives. This was noticed in our study where high prevalence of allergic rhinitis was seen among cousins and relatives compared with non relatives. In a study by Aberg (1993) of Swedish school children and their parents, it was reported that maternal history was found to be twice as common as paternal history. The children of affected mothers contracted atopic disease in the same proportion as the children of affected fathers yielding twice as many affected children with affected mothers than with affected fathers. Children are exposed to allergens at home and at school. The common allergens that produce allergic rhinitis are the indoor and outdoor inhalants. The relative importance of allergens whether pollens, fungal spores or animal danders depends on various factors such as the relative humidity, the habits of people, the type of housing (old or new) and the use of air conditioning. The prevalence of possible contribution of allergens of indoor origin (house dust mites, cockroaches, animal allergens, and allergens of plant origin) was studied in various regions in Saudi Arabia (Al Frayh et al., 1989; Hasnain et al., 1989). Carpets are used in almost all houses. Cat allergens are found both indoor and outdoor. The cat allergens found in cat's dander and saliva contribute to inhalant allergen in Saudi Arabia. The association between bronchial asthma and allergic rhinitis has been well known for a long time. In our study, 649 out of 2529 children had bronchial asthma constituting 25.66%. Rhinitis and asthma are very common co-morbidities suggesting the concept of "one airway, one disease." The structure of the airways mucosa presents similarities between the nose and the bronchi and both are characterized by a pseudostratified epithelium with columnar ciliated cells resting on a basement membrane. The pathogenesis of allergic rhinitis is based upon interactions of allergens with membrane-bound allergen-specific IgE on the surface of mediator cells, i.e. basophils and mast cells, leading to

Table 4. Distribution of children according to province (region) and parent's relation.

Province	No surveyed	No with Allergy	% In each Province
Central	3800	943	42.82
East	647	189	29.21
Southern	1035	338	32.66
West	4058	1059	26.09

the release of allergic mediators (both preformed and newly synthesized) including histamine, leukotrienes, and eosinophil cationic protein (ECP). These factors are responsible for both immediate allergic responses characteristic of allergic rhinitis and the late inflammatory reactions responsible for chronic allergic rhinitis (Berger, 2001). The recent inflammation plays a critical role in the pathogenesis of rhinitis and asthma. The occurrence of allergic rhinitis in the paediatric population is increasing probably due to the environmental changes in the country. Bermuda grass, which grows extensively in the Saudi environment, and mesquite produce the most common reaction, as well as Chenopodacea and cockroaches. Many children showed reaction to cat fur although they don't have cats in their houses. This is due to the presence of many wild cats in the streets. Our study to a correlation between hearing impairment among rhinitis and non-rhinitis groups showed a high prevalence of hearing impairment within the rhinitis group ($p > 0.001$). This may be due to Eustachian tube dysfunction, infection and mucosal inflammation induced by antigen-specific immune reactions. The relationship between rhinitis and otitis media with effusion (OME) has been the subject of controversy. The incidence ranges from 4% to 90% in an uncontrolled study (Corey et al., 1994)

CONCLUSIONS

1. The prevalence of allergic rhinitis in children is increasing in Saudi Arabia as it is in other countries in the world.
2. Saudi Arabia is constituted of different geographical areas and the prevalence rates of allergic rhinitis varies in the different provinces; urbanization and the use of carpet, air conditioning, household pets are new factors in this country.
3. The prevalence of allergic rhinitis was found to be higher among children of consanguineous parents and those with positive family history of allergy. This may indicate hereditary genetic risk factors.
4. There is a high prevalence of HI within the rhinitis group.

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