Original Article

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Allergy Skin Tests in Inner-City Children with Allergic Rhinitis Living in İstanbul

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Abstract

Objective: Lifestyle and environmental factors are considered to play an important role in the large variations in the prevalence of symptoms of allergic rhinitis (AR) and allergen sensitization. The aim of the present study was to investigate allergen sensitivities together with clinical features and biochemical characteristics of urban children living in İstanbul.

Methods: A total of 2822 patients aged between 2 and 18 years living in Istanbul city center and diagnosed with AR in our allergy polyclinic were included in the study.

Results: There were 1095 (38.8%) female and 1727 (61.2%) male patients. The most common susceptibility was to house dust mites, the second was to sweet vernal grass, and the third was to cocksfoot grass.

Conclusion: The present study demonstrated that house dust mite is the most common allergen in inner-city children with AR living in Istanbul. Screening house dust mite allergen in inner-city children may be a useful tool in the diagnosis, planning of allergy prevention, and immunotherapy of children suspected with respiratory allergies.

Keywords: Allergic rhinitis, children, house dust mite, inner-city

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INTRODUCTION

Allergic rhinitis (AR) is a chronic inflammatory disease of the nasal mucosa with symptoms including paroxysmal sneezing, rhinorrhea, nasal obstruction, and postnasal discharge, often accompanied by nasal, eye, and palate itching (1-3). It is one of the most common diseases of childhood. In recent years, the incidence of AR has increased worldwide, especially in people living in urban areas (4, 5). Most of the developing countries are becoming more urbanized and Westernized, with people changing their habits. Lifestyle and environmental factors are considered to play an important role in the large variations in the prevalence of symptoms of AR and allergen sensitivity.

Allergic rhinitis is a complex disease in which genetic and environmental factors play a role. It is basically the result of an antibody response developed by a hyper-reactive immune system to an allergen it has previously encountered. Allergic sensitization and immune dysfunction developing as a result of increased T helper cell type 2 response are thought to play a key role in the development of AR. One of the factors involved in the pathogenesis is allergen sensitivity. The easiest and cheapest way to detect sensitization to allergens is by allergy skin test (AST).

İstanbul is the largest metropolis and one of the major business, cultural, and core centers in Turkey. Internal immigration toward Istanbul increased after the 1950s because it was the fastest-growing financial and industrial center, and it still continues to grow, albeit more gradually (6-8). The aim of the present study was to investigate allergen sensitivities together with clinical and biochemical characteristics of children living in the urban area of İstanbul.

METHODS

A total of 2822 patients aged 2-18 years who were followed up with a diagnosis of AR in the outpatient clinic of Children's Allergy and Immunology from January 1, 2010 to December 31, 2013 were included in the study. İstanbul is the most important and crowded metropolis in Turkey, with a population of approximately 14.7 million (6). Two-thirds of the city's population lives in the European part and the rest in the Asian part. Most of the patients also live in the European part.

A detailed history was obtained from all patients, and physical examinations were performed. Data on patients' age, sex, family history of atopy, presence of additional allergic disease, serum total IgE levels, and eosinophil percentage in the complete blood count were recorded. Patients with a serum total IgE level >100 kU/l and/or positivity to at least one allergen in AST were considered as atopic.

Prior to allergy skin testing, patients were advised not to take systemic or topical drugs that could affect the test results, including antihistamines, corticosteroids, and immunosuppressive agents, for 10 days before testing and leukotriene antagonists for 1 day before testing.

The AST was performed with standard methods. A total of 34 allergen extracts were used: (Stallergenes, France) *Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*, *Blattella germanica*, *Felis domesticus*, *Canis familiaris*, *Aspergillus fumigatus*, *Penicillium mbcture* (*P. digitatum*, *P. expansum*, and *P. notatum*), *Cladosporium* mix (*C. cladosporioides*, *C. herbarum*, and *A. niger*), *Rumex acetosa* (sorrel), *Urtica dioica* (stinging nettle), *Plantago* (*sm\rot\x*), *Artemisia vulgaris* (absinthe), *Chenopodium album* (white goosefoot), *Parietaria officinalis* (upright pellitory), *Lolium perenne* (British grass), *Anthoxanthum odoratum* (sweet vernal grass), *Dactylis glomerata* (cocksfoot grass), *Festuca elatior* (meadow fescue grass), a mixture of 7 grains (barley, corn, oats, rice, rye, wheat, and wheat flour), *Alnus glutinosa* (alder), *Fagus sylvatica* (beech), *Betula alba* (birch), *Corylus avellana* (hazel tree), *Quercus robur* (red oak), *Olea europaea* (olive), *Populus alba* (poplar), *Salix caprea* (willow), false acacia (acacia), latex, cow's milk, egg white, egg yolk, banana, and cocoa. Histamine (10 mg/mL) was used as positive control, with saline solution as negative control. A drop of (0.01-0.02 mL) allergens and positive and negative control extracts was applied to the interior section of the forearm, and the skin was pierced at 90° with a lancet over each drop. The assessments were made 20 min after the test was applied; a bulging diameter ≥3 mm was considered positive, with respect to negative control. Patients with a positive result to at least one of the allergens were considered AST positive.

Table 1. Demographic, clinical and biochemical characteristics of patients

Findings	
Clinical findings	% (n)
Age (year)	
2-5	41.5 (1170)
6-12	45.9 (1294)
>12	12.7 (358)
Additional allergic disease	
Asthma	49.3 (1392)
Atopic dermatitis	5.8 (165)
Atopy in the family	55.3 (1560)
Laboratory findings	Mean±SD (range)
Serum total IgE (kU/l)	310.5±423 (5-2930)
Serum eosinophil (%)	3.3±313 (0.1-15.7)

Patients >18 years or <2 years, using medications that could affect AST results (antihistamine, corticosteroids, etc.) and/or treated with allergen immunotherapy, taking beta-blockers, and who did not sign the consent form were excluded from the study.

Serum total IgE values were analyzed by a chemiluminescent immunometric system (IMMULITE 2000 XPi); values >100 IU/mL were considered high. Total eosinophil count was analyzed by CELL-DYN 3700, and values >4% were considered high. Approval for the study was obtained from the İstanbul University Ethics Committee (2014/991).

Statistical Analysis

Statistical analysis were performed using Statistical Package for Social Sciences version 19.0 (IBM SPSS Corp.; Armonk, NY, USA). Parametric data are expressed as mean±standard deviation. Qualitative variables are presented as frequency and percentage (%). Categorical data were evaluated using the chi-square test. A p-value <0.05 was accepted as statistically significant.

RESULTS

Recruited patients aged 2-18 years included 1095 (38.8%) female and 1727 (61.2%) male patients. Table 1 shows the demographic, clinical, and biochemical characteristics of the patients.

The serum total IgE level of 58.6% of the patients (n=1654) was >100 kU/l. In our study group, 79% of the patients were atopic, and 21% were non-atopic. Eosinophilia was detected in 27.9% (n=787) of the patients, and 62.5% (n=1765) were found to be positive to at least one allergen. The most common allergen found in our study is house dust mites, and the other allergens are shown in Table 2.

When these results were evaluated, it was found that the most common susceptibility was to house dust mites, the second was to sweet vernal grass, and the third was to cocksfoot grass. Our study showed that susceptibility increases with age.

Moreover, susceptibility is higher in participants with an IgE level >100 and eosinophilia (eosinophils >4%) ($p<0.0001$ and $p<0.0001$, respectively). However, accompanying atopic dermatitis or asthma does not increase susceptibility ($p>0.05$). Factors affecting susceptibility are shown in Table 3.

Table 2. Allergens detected during allergy skin test

Allergen	% (n)	Allergen	% (n)
House dust mite type 2	43(1214)	Willow	2.8 (79)
House dust mite type 1	42.4 (1197)	Alder	2.8 (79)
Sweet vernal grass	11.1 (314)	Upright pellitory	2.7(76)
Cocksfoot grass	10.2 (289)	White goosefoot	2.5 (70)
Cat hair	9.7 (273)	Acacia	2.3 (65)
Meadow fescue grass	9.6 (270)	Latex	1.8(50)
Dog hair	7.8 (220)	Olive	1.7 (48)
Grain mix	7(198)	Birch	1.6 (46)
Sorrel	6.2 (176)	Beech	1.6 (46)
Penicillium	5.8(163)	Poplar	1.6 (44)
British grass	5.7(161)	Egg white	1.6 (44)
Cockroach	5.6 (157)	Hazelnut	1.5(42)
Aspergillus	5.1 (43)	Red oak	1.4 (40)
Stinging nettle	4.8(135)	Cocoa	1.2 (34)
Common plantain	3.5 (99)	Banana	1 (27)
Cladosporium	3.2 (91)	Milk	0 (l)
Absinthe	2.9 (81)	Egg yolk	0 (l)

Table 3. Factors affecting susceptibility

Features	AST (+) % (n)	AST (-) % (n)	p-value
Age (years)			
2-5	56 (655)	44 (515)	
5-12	66 (854)	34 (440)	
>12	71.5 (256)	28.5 (102)	<0.0001
Ig E (kU/l)			
≥100	73.1 (1209)	26.9 (445)	
1-99	44.9 (439)	55.1 (539)	<0.0001
Eosinophilia (%)			
≥4	75.6 (595)	24.4 (192)	
<4	55.8 (877)	44.2 (695)	<0.0001
Additional allergic disease			
Isolated AR	60.2 (761)	39.8 (504)	
Asthma and AR	64.7 (901)	35.3 (491)	
Atopic dermatitis and AR	62.4 (103)	37.6 (62)	0.05

DISCUSSION

Allergic Rhinitis is one of the most common chronic diseases. Genetics, environmental factors, and geographic and climatic changes are important in the development of this condition. In recent years, the incidence of AR has increased worldwide, especially in people living in urban areas (4, 5). According to the International Study of Asthma and Allergies in Childhood (ISAAC), the prevalence of allergic rhinoconjunctivitis ranges from 1.4% to 39.7% in adolescents aged 13-14 years (9). A number of studies investigating the prevalence and various risk factors for AR in different age groups have been performed in Istanbul by this study group (10, 11). In a recent prevalence study conducted on children aged 6-7 years in Istanbul, the doctor-diagnosed rate of AR was 8.1%, and the incidence of rhinitis symptoms at any time was 44.3% (11). The risk factors for AR in schoolchildren include a family history of atopy, male sex, birth during the pollen season, early use of antibiotics, having frequent upper respiratory tract infections, being breastfed for <6 months, exposure to cigaret smoke in the first year of life, perianal redness, history of food allergy, living in places with intense traffic, exposure to indoor allergens, such as house dust mites, serum total IgE level before the age of 6 years >100 IU/mL, and presence of allergen-specific IgE (10-15). Our study population consisted of children living in the inner-city, and more than half had a family history of atopy. AR is diagnosed by history, presence of characteristic symptoms, presence of risk factors, and supporting findings during physical examination. In AR diagnosis, routine laboratory tests are usually normal. However, elevated levels of IgE antibody and peripheral blood and nasal eosinophilia may be seen, but they are not specific for diagnosis. In our study, serum total IgE was at the atopic level in most of our patients.

Allergic rhinitis can occur concurrently with other allergic diseases. According to the ISAAC study, major allergic diseases have become increasingly widespread. A significant proportion of patients with AR also have asthma (9). In our study, 49.3% of the patients also had asthma and 5.8% also had atopic dermatitis.

Identifying allergic sensitivities and taking necessary precautions in patients with AR are important to increase the quality of life of children and their families. In a study conducted by Lee et al. in South Korea, the sensitization rate to allergens was found to be 70.1%; AR was highest in children from 13 to 19 years, and the highest sensitivity was to house dust mites. Their study was conducted in Seoul on patients aged 5 to 88 years, and it showed that patients with the highest sensitization rate are in the 13-19 age group. This finding may be relevant to time spent indoors because of long hours spent in school by this age group. Additionally, the study at issue questioned the susceptibility change between the years 2007 and 2011 and established an increase in sensitization toward all of the allergens (16).

A study conducted on an unselected population of children in Italy detected a prevalence of positive results to AST of 17% among 456 patients, and the most common allergen was house dust mites (17). This study was performed in a rural area of southern Italy, which may explain the low prevalence.

In a study conducted in Ankara on a pediatric population (2-18 years) with suspected respiratory allergies, sensitization to any allergen was found to be present in 35.1% of 2457 children. The most common sensitizations were to grasses (15.6%-20.5%), house dust mites (7.6%-8.9%), and cats (4.7%) (18). Ankara is located in the center of Turkey and is surrounded by mountains. This city has a dry summer continental climate due to its elevation and inland location, and its flora consists of common meadows. The low prevalence of sensitization to house dust mites could thus be related to its climate and geographic location.

In a study conducted by Ayvaz et al. on 756 allergic children in the region of Trabzon, 55.6% of the children had a positive response to at least one allergen, and 70% of the patients were sensitive to grass and weed pollen. The second most common allergen was house dust mites (61.3%) (19). Trabzon is a city in the Black Sea region, and most of the city is covered with forests. High sensitivity rates to both grass and weed pollen and house dust mites can be explained by high humidity and geographic properties of the region.

In the present study, approximately half of the patients had house dust mite sensitization. Istanbul is located in northwestern Turkey within the Marmara region, with a coastline on two different bodies of water to the north and south. It has a borderline Mediterranean climate, humid subtropical climate, and oceanic climate due to its location in a transitional climatic zone. Its persistently high humidity and climate can explain high house dust mite sensitization in inner-city children.

CONCLUSION

The present study demonstrated that the most common allergen in inner-city children living in Istanbul is house dust mites. Although house dust mites are one of the major allergens worldwide, appropriate allergy panels might be developed according to sensitization to allergens for specific regions. Screening for house dust mite allergy in inner-city children may be a useful tool in the diagnosis, planning of allergy prevention, and immunotherapy of children with suspected respiratory allergies.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of İstanbul University (2014/991).

Informed Consent: Written informed consent was obtained from the parents of the patients who participated in this study.

Peer-review: Externally peer-reviewed.

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