Cockroach Sensitivity in Inner-City Allergic Patients in Turkey

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Abstract

Objective: Cockroach (CR) allergens known as a major component of the house dust might contribute significantly to the increase of allergic symptoms as the proportion of CR infested houses is growing, particularly in inner-city districts. We conducted this study to find out the prevalence of CR sensitivity among 214 urban settled allergic patients.

Measurements: Skin prick tests (SPTs) were performed with *Blatella germanica* extract along with the common inhalant allergens. Specific IgE determinations were carried out in patients with CR positive SPT.

Results: A total of 30 patients (14%) were found to have CR reactivity. We observed an association with atopy as well as with cutaneous reactivity to other indoor allergens; twelve (40%) had also sensitivity to mite allergens and three to both moulds and danders.

Conclusions: These data confirm the higher risk of CR allergy among atopic population sensitized to indoor allergens in Turkey. Thus cockroach sensitivity, which is widely spread among our allergic patients, should be taken into consideration when prescribing adequate treatment.

Turkish Respiratory Journal, 2001;2 (1):17-20

Key words: *Cockroach sensitivity-allergy, inner-city, skin tests, specific IgE*

Introduction

Immunoglobulin E (IgE) mediated allergy is a serious medical problem worldwide. The importance of various indoor allergens in the increased prevalence of allergic diseases has been reported (1,2). The most important indoor allergens identified by spesific IgE responses are those derived from dust mites, pet danders, molds, and cockroaches (CR). Recent increases in morbidity have been linked in part to CR allergen exposure which is known to be an important part of the house dust (HD) composition, particularly in lower socioeconomic communities (1,3).

CR antigens (proteins found in the insects' feces, saliva, eggs, and shed cuticles) have been implicated as one of the leading causes of asthma among inner-city patients. CR allergen levels at homes is a risk factor for decline in FEV_1. In a study carried out among adolescents, higher rates of sensitization for CR was observed in the lowest-income subjects and higher levels of CR allergen Bla g 1 –the predominant indoor allergen in the inner city– were found at their homes (4).

Cockroaches commonly found in urban dwellings worldwide, have increasingly been recognized as one of the

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major causes of inhalant allergy and asthma in Turkey, as well (2,5,6). Thus the aim of this study was to evaluate the prevalence of CR sensitivity in a group of allergic patients living in an urban area in Turkey.

Materials and Methods

We retrospectively assessed the prevalence of CR allergen sensitivity among an outpatient population observed at an adult allergy clinic in Ankara, Turkey.

A total of 214 randomly selected patients –all from inner city Ankara– with a clinical history of allergic disorders, mainly of respiratory system, have been enrolled in this study. All of them were referred in order to confirm a possible sensitization to some of the airborne allergens. Subjects who consented to the study were interviewed to determine the status and duration of their disease.

Skin prick tests (SPTs) were performed with commercially available cockroach antigen *Blatella germanica (B.g)* along with a common battery of standardized inhalant allergen extracts (Stallergènes S.A.-Pasteur, France). Histamine hydrochloride 1mg/ml and phenolated glycerol-saline served as positive and negative controls. SPT responses were read at 15 minutes and considered positive when any reaction was greater than 50% of that induced by the histamine control.

Serum samples collected from each subject for determination of total IgE (Abbott Laboratories, IL, USA) and/or specific IgE (MAST-CLA1, Mountain View, CA, USA) were centrifuged and stored at -20°C until assayed.

Data analysis was performed using SPSS for Windows. Chi-Square analysis was used to examine the association between skin test positivity to CR as well as to other allergens and the independent variables, like age, sex, total and specific IgE levels, type of allergic disease, etc. Two-tailed *P* values were calculated with 95% confidence interval (CI) and a *P* value of < 0.05 was regarded as significant.

Results

Of the 214 patients (146 female and 68 male, mean age 37±15.1 years) tested, majority claimed asthmatic symptoms (43.9%), while only 22% had rhinitis, 17.3% were diagnosed as having both rhinitis and asthma, and the rest (16.8%) had allergic symptoms unrelated to the respiratory system ($p<0.05$). Although women had more frequent clinical manifestation of allergic diseases than men (84.3% and 81.1% respectively, $p>0.05$), more male subjects suffered rhinitis (36.8%) while 50.7% of females claimed asthmatic symptoms ($p<0.05$).

The prevalence of positive SPTs to the main inhalant allergens was found to be 51.9% (CI 95% 49.4-54.3) with no difference between the sexes. In SPT positive group (atopics), pollen sensitivity was the most prevalent (39%, CI 95% 36.8-43.4) distantly followed by sensitivity to mites (19%, CI 95% 17.9-20.2) (Figure 1). The frequencies of sensitivity to other indoor allergens were 7% (CI 95% 5.5-9.0) for dog dander, and 6% (CI 95% 5.6-8.0) both for cat dander and moulds, respectively.

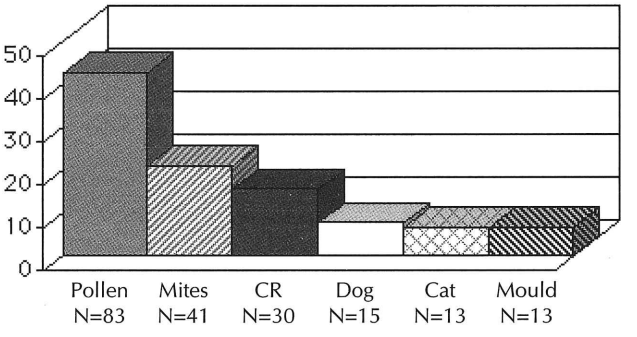

***Fig. 1**. The incidence of sensitivity to the common inhalant allergens.*

A total of 30 patients (14%, CI 95% 12.9-15.6) were found to have positive SPT reactivity to CR antigen (*B.g.*). Of the CR positive cases, four patients had positive serum Spe IgE levels (>Class 1) (Table 1). Among patients with CR positive SPT, 13 patients (43%, CI 95% 38.4-45.0) had pollen positive SPTs, while 12 (40%, CI 95% 38.5-42.0) had also sensitivity to mite allergens, three (10%, CI 95% 9.2-11.8) to both moulds and danders while all but four had high serum total IgE levels (>120 IU/ml). Therefore, an association with atopy ($p<0.001$) and cutaneous reactivity to other indoor aller-

Table 1. Characteristics of the CR sensitive patients

	TOTAL= 30		
	F: 21 (70%)	M: 9(30%)	Mean
Age (years)	44±25.5 (20-76)	36±1.4 (28-54)	44±25.5 (20-76)
T. IgE (IU/ml)	881±451.4 (71.4-1611.4)	394.9±458.6 (70.6-2497.2)	881±451.4 (71.4-1611.4)
Spe. IgE (>Class 1)	3 (14.3%)	1 (11.1%)	4 (13.3%)
Asthma	3 (14.3%)	2 (22.2%)	5 (16.7%)
Rhinitis	10 (47.6%)	6 (66.7%)	16 (53.3%)
Asthma + Rhinitis	8 (38.1%)	1 (11.1%)	9 (30%)

gens, namely HD mites ($p=0.02$), danders ($p<0.05$), and fungi ($p<0.05$) were observed, in patients with CR sensitivity. When the results taken together, the variables with no statistical significance ($p>0.05$) included age and type of allergic disease.

Discussion

Environmental allergen sensitization and exposure may be cofactors contributing to the increased disease severity in the urban populations (7). The dose response between exposure to CR allergen and sensitization has been shown even in low doses of allergen. Sarpong et al had suggested that Bla g 1 levels greater than 1 U/g in the school dust should be considered clinically significant levels of exposure –with a plateau above 4 U/g of dust– and a very important "occupational" risk to students, teachers, and other school workers (8). Likely, the rate of CR sensitization was related to the level of bedroom exposure as, > 80% of children with bedroom Bla g 1 and Bla g 2 of 1 U/gm or greater demonstrated skin sensitivity to CR allergen (9).

As quantities of CR allergens were not analyzed in this study, we have no information on the extent of exposure to CR. However, our data once more demonstrate that high indoor allergen exposure, as well as outdoor allergens, is a risk factor for developing sensitization in an urban settled patient group, while indoor allergen sensitivity altogether makes more than half (52%) of the SPT reactivity in our study population.

Although, mites are the most important indoor allergen in our area as was found in an earlier study (10), CR allergens known as a major component of the HD composition, might contribute significantly to the prevalence of the respiratory symptoms (6,11,12). The prevalence of CR sensitivity in this study (14%) seemed to be within the range reported in some atopic populations (5,13,14).

Three most found CR species are *Periplaneta Americana (P.a.), Blatella germanica (B. g.), and B. Orientalis (B. o.).* Thus the German cockroach (*B. g.*) which has been regarded as the most widespread with a high immunologic potential, is also found to be the most common CR in Turkey (6,8,15).

Socioeconomic status and race are risk factors for CR allergen exposure and sensitization (4). Children from low socioeconomic background were found to be at fourfold risk of being exposed to CR allergen in their bedrooms compared with the children from middle –or high– income families (3). Although individual measures of socioeconomic status were not investigated in this study, all the patients were living in Ankara, the capital city of Turkey, with a well known characteristics of habitants mostly employed and covered under social security system.

It is well known that the rate of CR sensitization is quite high among those subjects living in urban area (3,14). Mean levels of Bla g 1 are higher in the apartments than in houses. The higher frequency of CR infestation in apartments is often attributed to the difficulty of exterminating populations in an entire building. Other factors that are important are the size of the building, because CR infestation has been linked to overcrowded homes, as well as the age of the building. Furthermore, infestation can easily spread from one apartment to another. Differences in the allergen levels are noted between sites within the building. At home, CR allergen has been documented to be most prevalent in food-related areas such as the kitchen due to presence of food sources. Another factor that may influence CR growth is humidity (8). It was noted that the highest levels of major CR allergens Bla g 1 and Bla g 2 were recovered in summer, and these levels lag approximately 2 months behind the peak in the CR population (7,12,16). Reducing exposure to common indoor allergens, including CR, is an important anti-inflammatory treatment for inhalant allergy and asthma. This would result in the development of appropriate means for controlling CR allergen exposure both at home and outdoor settings. Despite lack of our knowledge about these points in our study population, it is not difficult to estimate that all participants were living in apartment buildings due to our country's structure.

Moreover, most of the CR allergic patients had also other inhalant allergies, and only nine subjects (30%) showed isolated CR sensitivity. Eggleston et al. found that the relationship between exposure and positive skin test responses was clearly stronger among atopic children with a greater number of positive skin test responses (9). It has been assumed that atopy modifies the relationship of exposure to sensitization. Our preliminary data seem to confirm a higher risk of CR allergy among atopic population sensitized to other indoor allergens. Although, this can not be assumed for outdoor allergens while in pollen sensitive group only 15% showed CR sensitivity. High rates of additional mite allergy suggest that there may be cross reactivity between these two allergenic sources (11). Several studies had shown a similarity with *Tropomyosins* in a large variety of extracts obtained from mites and other

household arthropods, crustaceans and arachnids could reflect the potential panallergenicity of this protein.

In conclusion, it can be proposed that CR allergens induce development of allergic symptoms in genetically predisposed individuals as the proportion of CR infested houses is increasing, particularly in inner-city districts. Therefore, indoor environmental analysis and *in vivo* diagnostic tests for sensitization to *B.g.* in individuals with perennial symptoms may be suggested in the assessment and management of allergic patients in Turkey.

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