

# The Study of Cockroach Allergy in Iranian Children with Asthma

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## Abstract

**Background:** Asthma is the most common chronic disease of childhood. Exposure to allergens plays an important role in asthma. Recently, cockroach has attracted attentions as an important allergen.

**Objective:** To evaluate cockroach allergy in Iranian children with asthma.

**Methods:** 100 children with asthma were studied. After determination of asthma severity, serum total IgE and blood eosinophils were measured. The patients were then skin prick tested with cockroach (*Blattella germanica*) and some common aeroallergens and food allergens. According to cockroach skin prick test (SPT) results, the patients were divided into two groups (sensitive and non-sensitive) and compared.

**Results:** Positive SPT for cockroach was detected in 29% of patients. Cockroach sensitive group had a more severe asthma ( $p<0.02$ ). Asthmatic patients with cockroach allergy had perennial symptoms ( $p<0.05$ ). A remarkable number of sensitive patients were born in winter ( $p<0.05$ ). Eosinophilia was more common in sensitive group ( $p<0.02$ ) and they had a higher level of serum total IgE ( $p<0.04$ ).

**Conclusion:** The prevalence of cockroach allergy was near to other common aeroallergens. Cockroach sensitive group had perennial symptoms, which are compatible with other indoor allergens. Cockroach allergy was more prevalent in children born in winter. May be these children are kept at home during their first months of life and are more exposed to cockroaches. The higher prevalence of eosinophilia and higher IgE level in sensitive group may be the reasons of more severe asthma in this group.

**Iran J Med Sci 2002; 27(4):156-160.**

**Keywords** • Asthma • child • cockroaches • hypersensitivity • Iran • skin tests

## Introduction

Repeated episodes of wheezing are a common, widespread problem in children<sup>1</sup> and asthma is the most common chronic disease<sup>2</sup> and therefore the most frequent admitting diagnosis in childhood.<sup>3</sup> Asthma has a great impact on children's activities and

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it causes a wide range of psychological problems in children and their families.<sup>3,4</sup>

It seems that asthma prevalence, morbidity and mortality have increased dramatically during the recent decades.<sup>2,3,4,5</sup>

Different contributors have been discussed as triggers for asthma. Exposure to perennial, indoor allergens is very common in young children and infants with asthma.<sup>6,7</sup> It is now well known that exposure to indoor allergens such as mite plays an important role.<sup>2,3</sup> Recently, cockroach has attracted attention as a prevalent and important allergen, causing and aggravating asthma.<sup>8-12</sup> There is some evidence that cockroach allergy aggravates asthma symptoms.<sup>13-15</sup> Rosensterich et al, in 1993 manifested that the most common allergy in asthmatic children among cockroach, mite and cat was cockroach. They also indicated that asthmatic children with cockroach allergy had more severe asthma than others.<sup>13</sup> In a study, performed by Sarpong et al, in 1998, 60% of asthmatic children, living in cities had cockroach allergy.<sup>16</sup> A high prevalence of cockroach allergy was reported from Brazil, as much as 55% in asthmatic patients<sup>17</sup>, but it is of a lower prevalence in Poland<sup>14</sup>, Italy<sup>18</sup> and Germany.<sup>19</sup>

The most common type of cockroaches is *Blattella germanica*, *Priplaneta americana* and *Blattella orientalis*.<sup>20</sup> In urban places, German cockroach is more prevalent.<sup>21</sup>

Different data on the prevalence of cockroach allergy is available. This study was designed to investigate cockroach allergy in Iranian asthmatic children.

### Patients and Methods

A sample of 100 children (6 m–12 y) with definite diagnosis of asthma, referring to allergy and immunology Department of Children's Medical Center and Karaj Allergy Clinic was collected. After obtaining primary information such as age, sex, season of birth, geographical living area, socioeconomic data, characteristics of their disease, and the severity of their disease were determined according to their personal history, physical examination and measurement of PEFr.<sup>3</sup> PEFr was measured with a single mini peak flowmeter, which was tested by one of the researchers every morning. Serum total IgE was measured, using ELISA method. The kits were obtained from IFCI CloneSystems SPA Bologna, Italy. Also, blood eosinophils were counted (The eosinophils count >350/mm considered eosinophilia).<sup>23</sup> The patients' stool was examined for parasites in three sessions, and the result was negative for all of them.

#### Skin prick test

The patients were skin tested, using prick method. A negative control (normal saline) and a positive control (histamine, 1 mg/ml) were also included. Patients with no response to negative control and positive response to positive control (with wheal diameter at least 5 mm) were skin tested with extracts of German cockroach (as the most prevalent existing cockroach in urban areas)<sup>21</sup>, cat, mite (DP), mixed trees (containing birch, beech, oak, alder, hazel, poplar, plane tree, elm and willow), mixed grasses (containing velvet, orchard, timothy, kentucky blue and meadow fescue), mixed weeds (mugwort, nettle, dandelion and English plantain), feather and some food allergens (milk, egg, wheat, fish, tomato). The extracts were obtained from Allergopharma Company, Hamburg, Germany.

Wheals and flare were read for histamine at 10 minutes and for allergens at 20 minutes. Responses were measured in millimeter. The test was considered positive if the diameter of the wheal was 3 mm or more.<sup>23</sup> The diameters of cockroach SPT responses were compared to histamine diameter and graded from 1+ to 4+.<sup>24</sup> According to cockroach SPT, the patients were categorized into two groups (sensitive and non-sensitive) and compared. It is obvious that cockroach non-sensitive group contains asthmatic patients with other allergies rather than cockroach.

Student's *t* test was used to compare the means and chi-square and Fisher's exact tests were employed to evaluate the relations between quantitative data. Statistical evaluation was done, using SPSS (version 10.5) software.

### Results

Our patients' age ranged from 6 months to 12 years (mean±SD: 6.2±3.1 y). Thirty-two percent were female and 68% were male. Positive SPT for German cockroach (*Blattella germanica*) was seen in 29% of the patients. Of the patients, 33.3% (20/60) had positive SPT to the mixed trees, 31% (18/58) to mite (DP), 26.6% (16/60) to grasses, 23.3% (14/60) to weeds, 20% (10/50) to feather and 15% (9/60) to cat. Ten percent of the patients (6/60) had positive SPT to egg and 5% (3/60) to milk. Only one of the patients had positive wheat SPT. In grading of cockroach SPT responses, compared with histamine response diameter, the responses were 1+ in 10.3% (3/29), 2+ in 24% (7/29), 3+ in 44.8% (13/29) and 4+ in 20.6% (6/29). Severity of Asthma in both sensitive and non-sensitive groups is shown in Fig 1. Severe asthma was seen in 30.8% of sensitive and 8.1% of non-sensitive patients, but the number of patients with mild and moderate asthma was similar in both groups (*p*<0.02).

The seasons with intensified symptoms are

**Table 1: Seasons with intensified symptoms in cockroach sensitive and non-sensitive patients**

Birth Season	Sensitive	Non-sensitive
Spring	3.8%	13.5%
Summer	7.7%	10.8%
Fall	3.8%	13.5%
Winter	23.1%	33.8%
All seasons	61.5%	28.4%

shown in detail in Table 1. In contrast with non-sensitive group in which only 28.4% had perennial symptoms, 61.5% of the sensitive patients had perennial symptoms, which is statistically significant ( $p < 0.05$ ).

The patients' season of birth is shown in Table 2. Of sensitive patients, 34.6% and of non-sensitive cases, 13.5% were born in winter, respectively ( $p < 0.05$ ).

Eosinophilia was more frequent in asthmatic children with cockroach allergy ( $p < 0.02$ ), and it was detected in 41.2% of sensitive and 21.6% of non-sensitive patients.

The mean  $\pm$  SEM of the serum total IgE level in the sensitive group was  $375 \pm 70$  IU/ml while in non-sensitive group it was  $212 \pm 32$  IU/ml. It is obvious that the difference of IgE level in two groups is remarkable ( $p < 0.02$ ). Also, as shown in Fig 2, we divided the patients' IgE level into four categories for comparison. There was also a statistically significant difference ( $p < 0.04$ ).

No socioeconomic and geographic difference was noted between sensitive and non-sensitive groups.

**Discussion**

Bernton and Brown described cockroach allergy in 1967.<sup>25</sup> Later, several studies were performed to further clarify this type of allergy. Recent studies have suggested a relationship between cockroach

**Table 2: Seasons of birth in cockroach sensitive and non-sensitive patients**

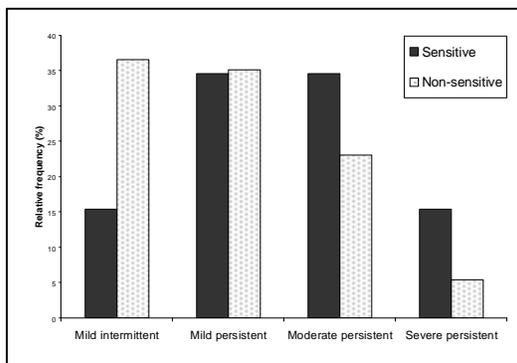
Birth Season	Sensitive	Non-sensitive
Spring	26.9%	27%
Summer	19.2%	32.4%
Fall	19.2%	27%
Winter	34.6%	13.5%

allergy and asthma.<sup>8-12</sup> This study was designed to elucidate this allergy in Iranian asthmatic children. Comparing the results of SPT to common aeroallergens (cat, mite, trees, weeds, grasses and feather) and cockroach, it is shown that cockroach is one of the main aeroallergens and is worth notifying especially in children, who have more exposure to indoor allergens. As seen in the results, a few patients had food allergy. Our patients' range of age was 6 months to 12 years (mean  $\pm$  SD:  $6.2 \pm 3$  y), but food allergies are common in the first year of life.<sup>26</sup>

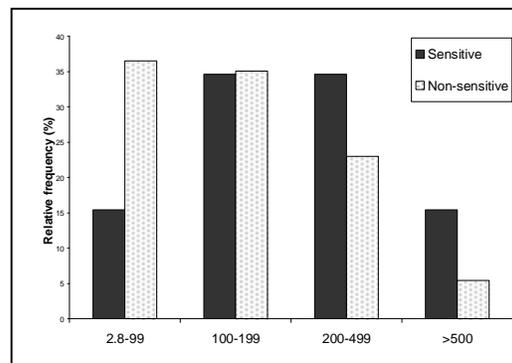
Positive SPT for German cockroach was seen in 29% of our patients, which is close to Harmanci's data from Turkey.<sup>27</sup> Probably there are some geographic reasons that our data and those of our neighboring country (Turkey) are similar, but our data is far from those of USA (30-60%)<sup>13,16</sup>, Italy (13%)<sup>18</sup> and Germany (8%).<sup>19</sup>

As shown in Fig 1, asthma in cockroach-sensitive group is more severe than non-sensitive group ( $p < 0.02$ ), implying that cockroach allergy causes asthma to become a more severe disease, which is compatible with other studies.<sup>13-15</sup>

For the first time, Sarpong et al, in 1998 found that asthmatic children born in winter were at a higher risk for cockroach allergy.<sup>16</sup> This point was confirmed in this study. The higher risk is possibly due to the fact that children born in winter are kept at home during the first months of life with a consequently higher exposure to cockroach allergen during these months.



**Fig 1: Comparison of asthma severity in cockroach sensitive and non-sensitive groups**



**Fig 2: IgE level classification in cockroach sensitive and non-sensitive patients**

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According to the results of this study, a great number of the sensitive patients had perennial symptoms. Cockroach is an indoor allergen, so symptoms in asthmatic children with cockroach allergy are commonly perennial.

Rosensteich in 1997 suggested that there is no relationship between socioeconomic state and cockroach allergy.<sup>13</sup> Recently, a correlation between low socioeconomic state and higher cockroach exposure and sensitization has been explained by Leaderer et al<sup>28</sup> No relation between cockroach allergy and socioeconomic state was found in this study. It seems that even children with good socioeconomic state are also exposed to this allergen.

As it was explained in the results, eosinophilia was more common in sensitive patients than non-sensitive. With regard to the significant role of eosinophils in asthma pathophysiology<sup>29</sup>, it can be a cause for the more severe asthma in sensitive group.

Also, serum IgE level in the sensitive group was higher than the non-sensitive group. Some studies have verified that children with higher IgE levels have more severe asthma.<sup>30</sup> Higher IgE level and eosinophilia in patients with cockroach allergy, therefore, may explain the severity of asthma in these patients.

## Conclusion

Cockroach allergy may be a significant contributor to children's asthma. Also it may cause the existing asthma to become a more severe disease. Cockroach allergen, therefore, should be noticed carefully in children's asthma, especially in severe types, thus avoiding these ugly insects should be considered as the first step of asthma treatment in children.

## Acknowledgement

With special thanks to all of our colleagues in Immunology, Asthma and Allergy Institute and to Mrs. Moghadasian, for editing the article.

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