

The comparison of sensitization to animal allergens in children and adult-onset patients with asthma

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Abstract

Background: With higher exposure to animal during the life, the risk of sensitization to animals may get more. The purpose of this study was the comparison of sensitization to animal allergens in children with asthma from those with adult-onset asthma. **Materials and Methods:** This cross-sectional study included 100 children and 100 adults with asthma as well as 100 healthy individuals with no history of asthma and atopy. Skin tests were performed in patients and controls to allergens using a panel of 15 animal allergens. **Results:** The rate of sensitization to animal allergens was 33% in children with asthma and 39% in patients with adult-onset asthmatics compared to 10% in the control group. Children with asthma were most commonly sensitized to dog (10%), hamster (8%), and cat (7%). Among patients with adult-onset asthma, the most common sensitizations were to dog (19%), canary (14%), and cat and goat (each 7%). The frequency of sensitization to animal allergens was not significantly different between children and adult-onset patients with asthma. **Conclusions:** We observed that sensitization to dog and canary was higher in adult-onset than children with asthma. Efforts to improve conditions at the public buildings to reduce the load of airborne allergens are also potentially helpful.

Keywords: Animal, asthma, skin test

Introduction

A consensus of opinion is growing that animal allergens can play a significant role in the development of asthma. [1],[2],[3],[4] Etiology, risk factors, and treatment of adult-onset asthma are different from childhood-onset asthma. [5]

In childhood asthma, the majority of patients have their first episode before the age of 6 years old. The main risk factors for this type are genetic predisposition, viral infections, bacterial colonization, allergic sensitization, and tobacco exposure. Atopy, allergy, and parental history of atopic diseases seem to be closely linked to asthma induction in childhood. [6],[7]

In adult-onset asthma, the first respiratory symptoms may occur from 12 to 65 years of age. Many risk factors responsible for the adult-onset of asthma are respiratory infections, hormonal factors, obesity, and stress. The role of genetic, atopy, and family history of asthma is less clear than in the childhood asthma. [8],[9]

Exposure to animals as a risk factor often arises in homes, work places, and public places. The most important animal allergens are derived from mammals and birds. Animal allergens are mainly produced in secretory glands and localized in animal skin and body fluids, such as urine, saliva, blood, milk, and sweat. Exposure to animals is not limited to direct contact, animal allergens can be transferred to environments that were never occupied by the animals. [10],[11] A recent report from our local region (Shiraz, Iran) showed that the cat, mouse, and other allergens were widely distributed in the home dust of families with children involved with asthma (under publishing data).

However, there are a few studies in sensitization to animal allergens on adult-onset asthma compared to childhood asthma. This study investigates the comparison of sensitization to animal allergens in children with asthma from those with adult-onset asthma.

Materials and methods

This study was carried out in a sample of 200 patients with asthma including 100 children and 100 adult-onsets who were referred to an allergy clinic at Ali-Asghar Hospital affiliated to Shiraz University of Medical Sciences, Shiraz, Iran. All patients were diagnosed with moderate to severe persistent asthma according to the Expert Panel Report 3. [12] Patients who were being treated with systemic corticosteroids, angiotensin-converting-enzyme inhibitors, or beta blockers were excluded from the study. One hundred unrelated healthy individuals including 50 children and 50 adults with no personal history of atopy were selected as the control group of the same ethnicity and from the same geographic region.

The study protocol was approved by our University Ethics Committee and each participant or child's parents signed informed consent prior to being tested. This study was carried out from January to August 2014.

Demographic information about age, gender, family history of atopy, keeping animal at home, and duration of direct exposure to animal was collected. Childhood asthma was defined as having first asthma symptoms before the age of 12 years and adult-onset asthma was defined ≥ 12 years. [6]

Pulmonary function was evaluated by spirometry tests (Cosmed, Rome, Italy) in all participants greater than 6-year-old. The best forced expiratory volume in 1 s (FEV1), ratio of FEV1 to forced vital capacity (FEV1/FVC) and peak expiratory flow (PEF) were measured, and values $< 80\%$ of the predicted value were considered abnormal. [13]

The skin prick test (SPT) was performed for all subjects with commercial animal allergens consisting canary feather, cat epithelium, cattle epithelium, chicken feathers, dog epithelium, duck feathers, gerbil epithelium, goat epithelium, guinea pig epithelium, hamster epithelium, horse epithelium, mice epithelium, parakeet epithelium, rabbit epithelium, and rat epithelium. SPT was done with commercial extracts of dust mites species (dermatophagoides pteronyssinus and dermatophagoides farina) too (Greer, Lenoir, NC, USA). Wheal diameter ≥ 3 mm greater than negative control was considered as positive sensitization. Histamine (10 mg/mL) and saline were used as positive and negative controls, respectively. The results

were analyzed 15 min after application. The subjects were instructed not to take any anti-histamine for 5 days prior to the skin test.

Sensitization to animals was recognized when at least one positive result of SPT to animal allergens occurred.

In statistical analysis, results were reported as mean $\pm$ standard deviation for the quantitative variables and percentages for the categorical variables. The groups were compared using the Student's t-test or Mann-Whitney U-test for the continuous variables and the Chi-square test (or Fisher's exact test if required) for the categorical variables. Statistical analyses were done using SPSS 15.0 (SPSS Inc., Chicago, IL, USA) and $P < 0.05$ was considered statistically significant.

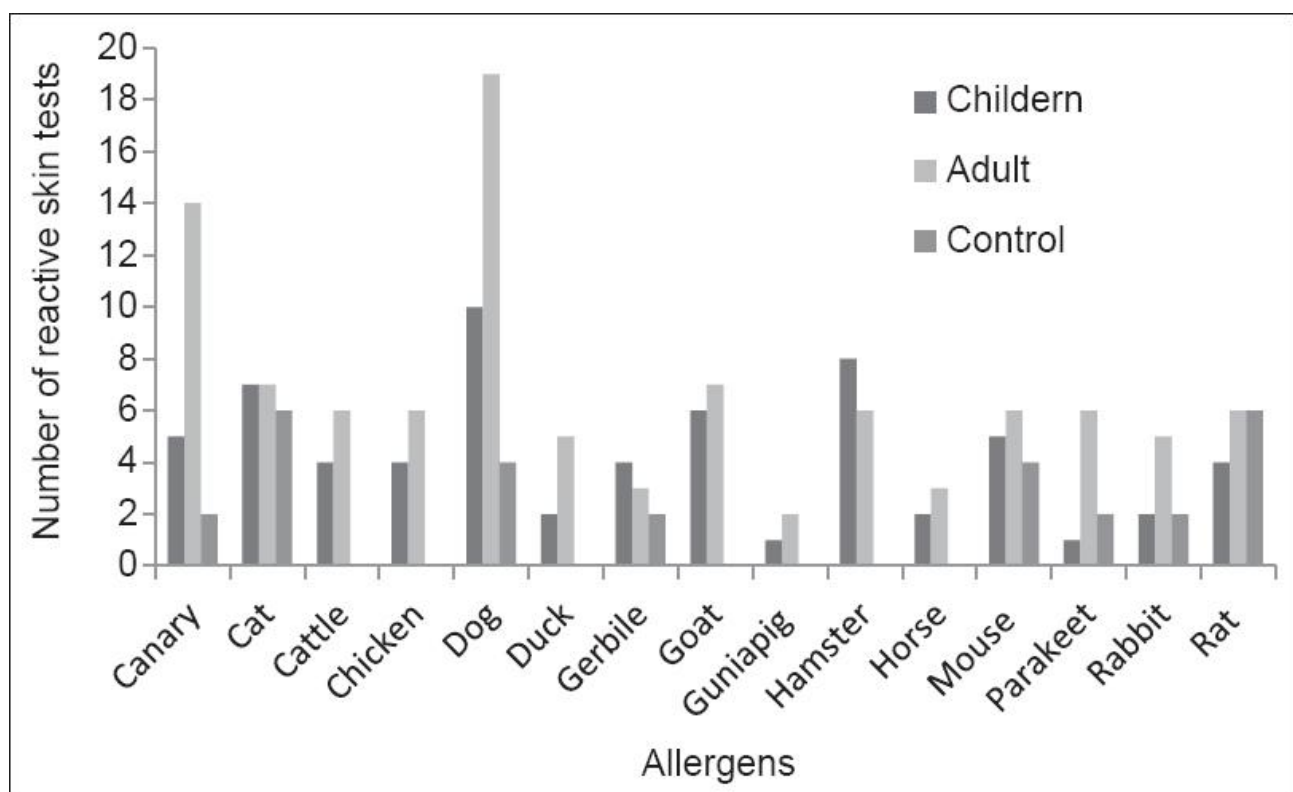
Results

One hundred children (35 girls and 65 boys) with moderate to severe asthma ranging in age from 1.5 to 15 years (mean age 6.63 ± 2.98) and 100 patients (65 female and 35 males) with onset of asthma in adulthood ranging in age from 19 to 65 years (mean age 37.10 ± 12.67) were enrolled in the study. One hundred individuals (54 female and 46 male) ranging in age between 3 and 54 (mean age 20.68 ± 13.82) were included in the control group.

A positive skin test to at least one of the applied animal allergens was seen in 33% of children, 39% of adult-onset, and 10% of control group. Animal sensitization in children with asthma did not differ significantly from those patients with adult-onset asthma.

[Figure 1] shows the rate of positive reaction to 15 animal allergen extracts by SPT in children and adult-onset patients with asthma as well as control group. As shown, the most frequent sensitization was to dog allergens in both groups of patients with asthma (10% in children vs. 19% in adults).

Figure 1: Skin reactivity to 15 allergen extracts in childhood- and adult-onset patients with asthma compared to control group



The rate of sensitization to cattle ($P = 0.04$), goat ($P = 0.03$), and hamster ($P = 0.007$) in children with asthma was significantly different from control group. The positive skin test to animal extracts of canary ($P = 0.002$), cattle ($P = 0.02$), chicken ($P = 0.02$), dog ($P = 0.001$), goat ($P = 0.01$), and hamster ($P = 0.02$) was significantly higher in patients with adult-onset asthma than control group.

In children with asthma, the duration of exposure to animals was ≤ 10 years (1.1 ± 2.0 years). In patients with adult-onset asthma, the duration of exposure to animals was ≤ 50 years (3.8 ± 8.5 years). No significant differences were observed between two groups of patients with asthma in the duration of exposure. The duration of exposure to animals in children with asthma showed correlation with positive SPT to animals ($P < 0.0001$).

Among 44 children with keeping animal at home, 24 (54.5%) showed a positive reaction to at least one animal allergens. Among 49 adult-onset asthmatic patients with having animals at home, 22 (44.8%) showed a positive reaction to at least one animal allergens. There was no significant difference in the risk of sensitization to animals after direct exposure to them between patients group.

Seventy children with asthma (70%) and 66 patients with adult-onset asthma (66%) had a family history of atopy. This factor has no effect on sensitization to animal allergens in both groups. Among 136 patients with parental asthma in both patients' groups, 73 kept animal at home (39 children and 34 adults).

The mean results of spirometry tests including FEV₁, FEV₁/FVC, and PEF did not significantly differ between the patients group.

Sensitization to dust mites (each or both *dermatophagoides pteronyssinus* and *dermatophagoides farina*) was detected in 14% of children and 25% of adults compared to 16% in control individuals. There was no difference in mite sensitization between the two patients' groups.

Discussion

Contact to animal allergens occurs during daily lifetime, thus increasing age are likely to put people at a higher risk of animal exposure. Following exposure to animals, their allergens might elicit IgE-mediated reactions in sensitized person. [14] Allergic sensitization was determined with SPT against animal allergens in our study. We found positive sensitization to at least one of the applied animal allergens in 33% of children with asthma, 39% of adult-onset asthma versus 10% in control group. This study showed that the rate of animal sensitization in children with asthma did not differ significantly from those patients with adult-onset asthma.

Although it remains unclear as to why individuals with different age-onset of asthma were the same susceptibility to animal sensitization, some explanations have been proposed. However, no certain susceptibility gene has been diagnosed for asthma; genetic background can be the same in both age groups of asthma. Then, it is possible that immune mechanisms other than IgE-mediated responses elicit an inflammatory response in adult-onset asthma which we did not consider it. A decline in IgE sensitization with age has generally been interpreted. [15] Furthermore, different studies have shown that exposure to animals has protective effects despite reported increased risk of others. [16] A cross-age study can provide a better evaluation to animal sensitization in patients with asthma while recruitment of a cross-age population is difficult.

In the current study, the highest prevalence of sensitization was to dog allergens in both patients' groups. High sensitization to dog allergens is due to passive transferring for this allergen by clothing, hair, or other surface from one environment such as public building to another setting. [10] The difference between the two groups of asthma in dog sensitization (10% vs. 19%) can be explained by the decreased likelihood of

tolerance in Iranian patients because of limited activity of keeping dog at home and direct exposure to them as religious beliefs.

The rate of sensitization to dog allergens by SPT was 19% in adult-onset patients with asthma while just 5% of them keep dog at home. All five adult dog ownership showed sensitization to dog in our study; this is an emphasis on Korean study that directly exposure to dog positively associate with the sensitization to them. [17] In contrast to our study, one report showed that dog ownership had no relation with sensitization to dogs. [18]

We found sensitization to canary in 5% of children (2% exposure) and 12% in adult-onset patients with asthma (8% exposure). Increases in the rate of sensitization may be related to high exposure to this type of bird allergen throughout their life. One study of Iranian veterinarians and animal workers showed sensitization to canary in 16% of the individuals that emphasize on the intensity of exposure for sensitization in this area. [19]

The results of the current study indicated that sensitization to hamster in children was more than adult-onset asthma (8% vs. 6%). The results of a study showed that mouse allergens were found in most of the homes of patients with childhood asthma (unpublished data). In attention to cross-reactivity among rodent allergenic epitopes, immunologic tolerance should also be taken into consideration because of high exposure to rodents during life.

In our study, sensitization to cat allergen was found almost the same (7%) in patients with asthma and the control group. Sensitization to cat allergens was reported from 7% to 45% in patients with allergy. [20],[21] and it may be explained by different living environments and the prevalence of cat ownership.

Our study showed that the rate of sensitization to cattle, goat, and hamster in children and canary, cattle, chicken, dog, goat, and hamster in adult-onset asthma can be a risk factor in the development of asthma. One study in Sweden found that sensitization to pets most closely associated with new asthma onset. [22]

The current study showed that just 50% of our patients who kept animals or birds at their homes were sensitized to animal allergens. Despite the intensity and degree of exposure to animal allergens in sensitization, negative skin tests might be a result of low potency of the allergen extracts, involvement with non-IgE-mediated reactions, and concurrent parasitic infections. [23]

We found parental asthma was not associated with less animal keeping; it is similar to Svanes et al. study. [24] It could reflect less awareness of potential symptoms or emotional factors being stronger than the concern for asthma.

The results of our study show that sensitization to two species of house dust mites was more in adult-onset asthma. House mites feed on human and animal scales; [25] therefore, higher exposure during lifetime increased sensitization to them.

Conclusions

There is little information in the literature regarding the age-specific effects of animal sensitization on patients with asthma. This study showed that animal sensitization has limited importance in difference of childhood asthma from those with adult-onset asthma. A cross-age study is needed for investigating the other underlying risk factors for asthma severity and poor clinical outcome in adult-onset asthma.

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Conflicts of interest

There are no conflicts of interest.

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