

## Cat Allergens in Homes of Cat Allergic Children without a Cat

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### Abstract

**Background:** Cat allergy is very common among atopic children in Istanbul although most of them have never had a cat in their homes.

**Methods:** Major cat allergen Fel d1 was measured in house dust samples of 25 atopic children and 15 non-atopic children.

**Results:** Fel d1 levels in house dust samples were similar in both study and control groups ( $64.8 \pm 72.8$  ng/g vs  $65.4 \pm 69.8$  ng/g, respectively).

**Conclusions:** Cat allergens are common in the house dust samples of allergic and non-allergic children living in Istanbul. Presence of cat allergens at homes may be due to the presence of the stray cats in the city.

**Keywords:** Allergen, Airborne allergen, Allergic Rhinitis, Bronchial Asthma, Skin prick test

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### Introduction

Many studies investigating the airborne levels of cat allergen have found significant levels of cat allergen at homes, schools, public buildings and office buildings [1-3]. It seems that individuals are exposed to cat allergens despite the absence of cats in their homes [4]. On the other hand, stray cats is a serious problem for allergic people because of free hairs on the streets. Istanbul is a city where stray animals especially cats and dogs are very common. Former studies have documented that cat allergens are very common in homes and schools in developed and developing countries and sensitivity to cat allergens is increasing [5-8]. In this study, we sought to document the existence of cat allergens at homes of children allergic to cat and non-allergic children.

### Materials and Methods

**Patients with positive skin prick tests:** Study subjects were selected from a group of individuals who presented to the Pediatric allergy and asthma clinic of Maltepe University between 2009-2013 for evaluation of allergic respiratory disorders. Skin prick tests for inhalant allergens were performed using a battery of common aeroallergens that included house dust mites, grass pollen mixture, weed pollen mixture, tree pollen mixture, cat dander, and dog dander (Laboratoire des Stallergenes, Cedex, France) with standard methods.

Skin prick tests were performed on the volar aspect of the forearm using Staller point needles (Laboratoire des Stallergenes). Histamine phosphate (1 mg/ml) was used as the positive control and phosphate-buffered saline as the negative control. The cutaneous reactions were read after 15 min and evaluated according to the size of wheal and erythema. Reactions with an induration >3 mm that of the negative control were considered positive. The study population consisted of children allergic to cat dander and who have never been exposed to a cat within their household. Parents of such 25 children accepted to collect house dust samples.

Control group consisted of 15 children who presented to the hospital for their routine pediatric visits and with negative skin prick tests. The control group also has never been exposed to a cat within their household.

The parents of children collected a minimum 50 g of house dust samples with a dry vacuum cleaner and bring to the laboratory.

### Extraction of dust samples and determination of cat allergen

The dust samples were sieved from 350 µm mesh to remove larger particles and to obtain a more homogenous amount of fine

dust for extraction. Samples were diluted in PBS-0.05% Tween 20 (w/v 1:20) and properly mixed on a vortex and rotated for 2 h on a shaker. The tubes were centrifuged at 1500g for 10 minutes and supernatants were transferred to a 1 ml Eppendorf tube and centrifuged at 7000 g for 10 min. Supernatants were kept at -80°C until analysis.

Extracted dust samples were analyzed for cat allergen, Fel d 1, with a monoclonal sandwich ELISA by using reagents from Indoor Biotechnologies Ltd. (Cardiff, UK). Briefly, microtiter plates were coated overnight at 4-8°C with mAb 6F9, at 1 µg/mL in 50 mM carbonate/bicarbonate buffer (pH 9.6). After washing, plates were blocked with 1% BSA-PBS-Tween 20 for 30 minutes. Standards (range 50 to 0,2 ng /mL Fel d1) and samples were added and incubated for 1 hour. After washing, 1/1000 diluted biotinylated monoclonal antibody 3EC4 was added and incubated for 1 hr. After the washing step, streptavidine horseradish peroxidase, diluted 1/1000 was added. Following incubation for 1 hr, plates were developed with 100 µL ABTS (2,2'-Azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) and the color reaction was measured at 405 nm using a microtiter plate reader and concentration levels were interpolated using a 4-parameter curve fit. Concentrations were expressed as nanogram in a gram of sampled dust [9]. The study was approved by the ethical committee of Maltepe University School of Medicine.

## Statistical Analysis

Data for means were presented ± standard deviation. Paired samples were compared using the Student's t test.

## Results

Skin prick tests were performed on 784 children and 562 (71.7%) of them showed a positive response to at least one allergen. Of these, 62 (11%) had a positive response with cat and 54 (87.0%) of them had another positive skin prick test response to at least one more allergen, mainly to house dust mites (Table 1). Fel d 1 levels in house dust samples were similar in children study and control groups (64.8 ± 72.8 ng/g vs 65.4 ± 69.8 ng/g, respectively, p>0.05).

## Discussion

Sixtytwo percent of American households and a smaller proportion of the European population have one or more domestic pet [10,11]. Although pet ownership is becoming increasingly more common among the families from upper socioeconomic groups in Turkey, it is not so common among the general population because of some religious and traditional beliefs. Unfortunately, sensitive statistics regarding this issue are not available. On the other hand, the number of free cats and dogs in the streets are increasing fast especially in big cities of Turkey like Istanbul.

Cat allergens are ubiquitous because of the small size of cat dander and are mostly airborne. They can occur everywhere including homes, day care centers and schools despite the absence of pets [3,12]. Felis domesticus (Fel d 1) is considered to be the major cat allergen because up to 90% of cat-allergic individuals are sensitized to it. Fel d1 is produced primarily in the sebaceous glands and is secreted onto the skin and fur [13] and is

**Table 1** Demographic and Clinical Characteristics of Children Allergic to Cat (n: 62).

	Number	%
<b>Ages</b>		
<5	6	9.7
10-Jun	29	46.8
11>	27	43.5
<b>Gender</b>		
F	34	54.8
M	28	45.2
<b>Clinical diagnosis</b>		
Asthma	20	32.2
Allergic rhinitis	12	19.4
Asthma+Allergic rhinitis	30	48.4
Allergic other than Fel d1	54	87.1
HDM	21	39.0
Pollens	13	24.1
Two or more allergens	17	31.4
Foods alone	3	5.5
HDM: House dust mites		

carried on small particles and remains airborne for long periods and it appears to be a unique marker for the presence of cats [14].

Sensitivity to cat allergen by skin prick testing have been found in 11% among our patients which has been reported to vary between 9%-17% by others [15,16]. Previous studies from Turkey have indicated a higher proportion (44.7%) among adults which may suggest that sensitization to cat allergen increases with age [17].

Most of the houses in Istanbul have airtight polyvinyl chloride windows and they don't have adequate ventilation. For ventilation, the windows of the houses are generally opened in the early hours of the day that may lead to entering of pollens and cat and dog feathers into the houses.

Fel d 1 levels were found to be 64.8 ± 72.8 ng/g in homes of our study group which have been reported to be 430 ng/g in homes without cats from UK and 100 ng/g from Ghana [6]. The high levels of cat allergens in UK homes may be due to the transportation of cat hairs from cat owners as cat ownership has been very common in the UK for many decades [18]. Another explanation might be prior cat habitation in these homes.

For our results, we speculate that cat allergens are coming from outside of the houses through the doors and windows and with the clothing of the household. Indeed, it has been shown that nearly 75% of cat allergic children have never lived in a house with a cat [19]. Interestingly, only 17% of the individuals who live with their cats are sensitized to their cats in comparison to 5% of dog owners [20].

Unlike dust mite allergens, cat allergens can be found at high levels even on walls and other surfaces within the home [21,22] and vacuuming the floors may not be sufficient to decrease the cat allergens. It has been suggested that even low level of cat antigens may induce the sensitization in some people [23].

These data suggest that some strict measures should be undertaken to prevent the entering of cat feathers into the

houses and to reduce indoor cat allergen levels. Since allergen avoidance has been shown to be an effective treatment for individuals sensitized with these allergens, every measure—such as feather proof curtains for the windows—should be undertaken to prevent entering of cat allergens into the houses. In an attempt to decrease the amount of cat allergens, increased ventilation of the homes, use of vacuum cleaners with effective filtration system and high-efficiency particulate air (HEPA) filters can also be considered. Keeping the stray cats in animal shelters can also be considered in order to reduce the outdoor cat allergens.

## Conclusion

Allergic sensitivity to cat antigens is a serious problem for atopic children living in Istanbul. Stray cats may be an important source

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