

Sensitization to cat without direct exposure to cats

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Summary

Background Allergy to pets, particularly cats, is one of the most important determinants of asthma and asthma-like symptoms in many parts of the world. Cat allergen is found in homes and public places without cats.

Objective The purpose of the study is to investigate the prevalence of sensitization to cat on the island of Tristan da Cunha where cats have been eliminated since 1974.

Methods A cross-sectional survey was conducted in 1993 on all residents on the island including allergy skin testing. Dust samples were collected from 20 homes on the island for measurement of house dust mite and cat allergens.

Results Positive skin test reaction to cat was present in 57 (20.1%) of all islanders and in six (12.8%) of those born in or after 1975, 1 year after cats had been exterminated. Five of these six residents were born within 5 years of extermination of cats; two of these had attended school outside the island. A low level of cat allergen (Fel d 1) was found in only one out of 20 homes even though house dust mite allergens (Der p 1 or Der f 1) were found in all homes.

Conclusion Sensitization to cat allergen occurs on the island of Tristan da Cunha where there is no direct exposure to cats. This is due either to the persistence of the allergen after the removal of the animal or to the allergen being brought in on visitors' clothing.

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Introduction

Allergy to cats has been shown to be an important determinant of asthma and asthma-like symptoms in many parts of the world [1,2]. In homes with cats, levels of the major cat allergen (Fel d 1), are typically very high. However, cat allergen has been found in almost all settled dust samples from homes without cats, as well as in public buildings such as schools, hospital, doctors' offices and shopping malls in low concentrations [3–8]. It is not known whether this low level of exposure leads to sensitization.

The purpose of this communication is to investigate the prevalence of sensitization to cats in an unique island, Tristan da Cunha, where a high prevalence of asthma has been reported for many decades. In this island, cats have been exterminated in 1974 because of a case of toxoplasmosis.

Methods

An asthma study was carried out in 1993 in which 282 island residents over the age of 5 years took part. The details of the study and the characteristics of the study population have been described elsewhere [9]. One hundred and two islanders had a positive clinical history of asthma alone or in combination with increased airway hyperresponsiveness. The study included taking a medical history, allergy skin tests and measurement of airway hyperresponsiveness. House dust samples were collected from the mattress and floor for measurement of house dust mite and cat allergen levels from 20 homes, representing about one-fifth of the dwellings on the island.

Allergy skin prick tests were done using 15 common allergens including house dust, two house dust mite allergens, cat, dog, horse dander and some pollens. Normal saline and histamine were used as negative and positive controls, respectively. A positive skin test reaction was defined as a weal size of ≥ 3 mm in diameter than the negative control. Atopy was defined as the

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presence of positive skin test reaction to one or more common allergens.

Two individuals were attending a school on the island of St Helena in 1993 and they were studied in 1996.

House dust samples were collected using a portable vacuum cleaner, with a special sock attachment. The socks had pore sizes between 5 and 10 μm in diameter. The bedroom floor was vacuumed once covering all areas. The bed mattress was vacuumed for 2 min. The socks were placed in zip-lock bags and stored at -20°C until analysis. Large particles were removed by sieving through a 300- μm mesh sieve before processing. Samples of dust were extracted in borate-buffered saline in the ratio of 100 mg to 2 mL, left overnight and filtered. Extracts were stored at -20°C until being analysed for allergen levels.

Monoclonal antibodies against purified Der p 1, Der f 1 and Fel d 1 antigens were used in the ELISA for quantifying house dust mite and cat allergen levels in these extracts [10,11]. Species-specific monoclonal antibodies were used to coat microtitre plates which were then incubated with the standard or the extracts. Bound allergens were detected using a separate biotinylated monoclonal antibody which recognized a different epitope on Fel d 1 for cat allergen and Der p 1 and Der f 1 for mite allergens, followed by the addition of streptavidin-peroxidase and 2,2'-azinobis-(3-ethyl-benzthiazoline-6-sulfonic acid)/ H_2O_2 substrate. The absorbance was read from an ELISA reader at 405 nm. The amount of allergens present in the dust sample was calculated from a standard curve and the lower detection limit of detection was 0.5 ng/mL.

Results

Positive skin test reaction to one or more common allergens was found in 47% of the islanders tested. The most common allergens they reacted to were *Dermatophagoides pteronyssinus* and *D. farinae* (37.5 and 34%, respectively). Positive

skin test reactions occurred in 20.1% with respect to cat dander, 8.8% to dog and 16% to horses.

Figure 1 shows the results of skin testing to animal and mite allergens according to whether they were born before or after 1975, 1 year after the extermination of cats. There were no significant differences between the two groups in the proportion of residents who reacted to the allergens except to horses. Of the 51 residents born during or after 1975, six (12.8%) reacted to cat, one (2.1%) to dog (who also reacted to cat) and three (6.4%) to horse only.

Some of the salient features of the six residents who reacted to cat are shown in Table 1. All were born within 5 years of termination of cats except one. Two were studying in a school on the island of St Helena at the time of this survey in 1993. They had allergy skin tests in 1996. None of their mothers had positive skin test reaction to cat.

Der p 1 levels were high in most homes, particularly in mattress samples while levels of Der f 1 were low (Table 2). Low level of Fel d 1 (1.1 $\mu\text{g/gm}$ dust) was detected in only one home. This home belonged to one of the two residents who attended school on the island of St Helena and had positive skin test to cat.

Discussion

House dust mite allergen is the most common allergen residents on the island Tristan da Cunha reacted to on skin testing. This is not surprising since relatively high levels of Der p 1 were detected in dust samples from houses on the island which has a high humidity throughout the year. The surprising finding is that as many as 20% of the residents reacted to cat dander at the time of the study almost 20 years after cats had been exterminated on the island. Moreover, six of these individuals were born 1 year or more after the

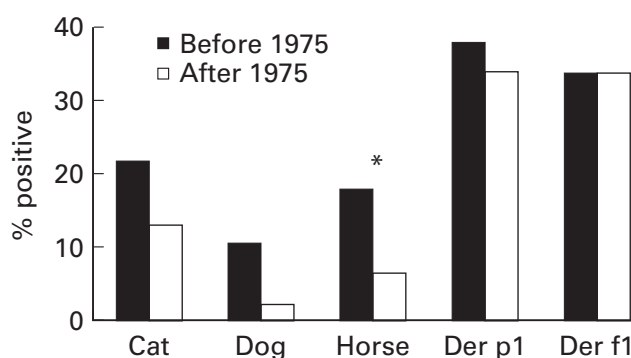


Fig. 1. Positive skin test reaction to cat, dog and horse dander and the two mite allergens for residents born before and after 1975. * $P < 0.05$.

Table 1. Year of birth and skin test reactivity of parents of subjects born during or after 1975 and allergic to cats

Subject	Year of birth	Positive skin test to cat	
		Mother	Father
1	1983	—	—
2	1975	—	—
3*	1978	—	+
4	1979	—	—
5	1976	—	—
6	1975	—	—

* Subjects 3 and 5 studied in a school of St Helena Island. Subject 5 had measurable Fel d 1 in one sample at home.

extermination. We have confirmed the absence of cat allergen, Fel d 1, in 20 homes representing one-fifth of all dwellings on the islanders with the exception of one sample.

Two of these six residents were probably exposed and sensitized to cats while they were studying on the island of St Helena. One of them might even have brought cat allergen to her home on Tristan da Cunha. Three other residents were born within 5 years of extermination of cats and had not been away from the island. It is possible that they were exposed and sensitized to residual cat allergen present in their home environment. Levels of cat allergen have been found to take a long time, from months to sometimes years, to decrease to undetectable levels after removal of the animal [12].

It is more difficult to explain sensitization to cats in the remaining individual who was born in 1983 and had not been away from the island. In communities where cats are common, cat allergens are prevalent, even in homes and public places where cats are absent [3–8]. This has been attributed to the nature of the cat allergen present in small particles and carried out on people's clothing. Tristan da Cunha is a very isolated island without an air strip, visited only by five to six ships per year. Few residents leave the island and return. Between 1961 and 1963, they were evacuated to England because of the appearance of a small volcano at the limit of the settlement; but this occurred before the extermination of cats. However, there still exists the possibility that these islanders could become sensitized to cat allergens brought in by visitors to the island.

Another possibility is *in utero* exposure to cat allergen. Cord blood T lymphocytes have been found to proliferate when stimulated by not only food but inhalant allergens such as house dust mite [13–15]. The significance of this finding is not clear as it is not known whether *in utero* exposure leads to sensitization.

Table 2. Mite and cat allergens in dust samples collected from 20 homes in Tristan da Cunha.

	Mattress	Floor
Der p 1	0.52 ± 1.9	0.04 ± 1.16
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Mean allergen level (µg/gm dust)†		
Der p 1	7.0 ± 2.3	2.4 ± 2.2
Der f 1	0.52 ± 1.9	0.04 ± 1.16
Allergen level ≥ 2 µg/gm dust, n (%)		
Der p 1	17 (85)	9 (45)
Der f 1	3 (15)	0 (0)

† = Geometric mean and sd.

Dogs are prevalent on the island, present in every home. One explanation for the occurrence of positive skin reaction to cat is the cross-reactivity between the IgE epitopes of the major cat and dog allergens [16–18]. However, this can only account for one individual born after 1975, who reacted to both cat and dog. Another possibility is cross-reactivity between cat allergen and allergens from animals other than dogs, as patients allergic to animals frequently display IgE reactivity to hair/danders from different animals. None of the residents born after 1975 reacted to both cat and horse.

In conclusion, sensitization to cat occurs on the island of Tristan da Cunha where there is no direct exposure to cats. This is likely due to the nature of the cat allergen which is being carried readily on the clothing of individuals and disseminated to other places, and to the persistence of allergen in homes long after the removal of cats.

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