

Clothing—an important source of mite allergen exposure

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The commonly cited sources of house dust mite allergen are beds, floors, soft furnishings, and soft toys. All have been identified as sites for modification and control measures in allergen avoidance trials.

We propose that insufficient attention has been paid to personal clothing as an important source of mite allergen. Clothing as an allergen source was referred to in one article in a category of household items,¹ and live mites were described in clothes in an article on mite counting methods.²

METHODS

To investigate the levels and quantities of the mite allergen Der p 1 in clothes, we collected dust from the clothes of 20 members of a University Department attending a midwinter celebration in a university laboratory in Sydney, Australia. There were similar numbers of men and women, and all were wearing the normal winter clothing of clerical, laboratory staff, and health professionals in a temperate region of the world (i.e., suits, open-necked shirts and pullovers, jackets, skirts, heavy cotton or woolen trousers, etc.). Dust was collected for 1 minute with a small portable vacuum cleaner from the upper, outer item of clothing (e.g., jacket, pullover, cotton top) either in situ or when the clothing was placed on a table. Each sample was collected in a separate bag. Owners were asked whether the clothing had been washed or dry-cleaned in the last month, and a record of the fabric type was made from the label.

To determine whether clothing contained live mites, 15 similar items, worn by the same persons, were subjected to a modified heat escape test.² Double layers of the clothing were suspended 20 cm above a reflecting heat lamp (100 W), and mites were collected on 20 × 10

cm sections of adhesive tape on the side away from the heat. The tape was removed when hot to touch, after 15 to 20 minutes. Two areas on each item of clothing were sampled. Mites on 5 × 10 cm sections of each piece of tape were counted under a stereomicroscope. Additional dust samples were also collected by vacuuming these 15 items. To estimate the proportion of total allergen contained in vacuumed dust samples after vacuuming, two woolen jumpers were soaked in 1.5 L of phosphate-buffered saline–0.05% Tween for 30 minutes, and then the liquid containing the extracted allergen was recovered by centrifugation. For the assay of allergen, all dust was sieved through a 400 µm pore filter, and 50 mg samples were extracted in 1 ml of phosphate-buffered saline, 0.2% bovine serum albumin, and 0.05% Tween for 30 minutes with rotation; the supernatant obtained by centrifugation was stored at –20° C before Der p 1 assay was performed with a double monoclonal assay.³ Results are expressed as micrograms of Der p 1 per gram of fine dust; geometric means and 95% confidence intervals are given in parentheses.

RESULTS

The quantities of mite allergen in the types of clothing are shown in Fig. 1. The mean quantity was 15.9 µg/gm (11.1, 22.9). All 35 items of clothing contained more than 2 µg/gm of allergen, 22 of them exceeded 10 µg/gm, and three exceeded 100 µg/gm. These allergen concentrations are similar to those found in floors and beds in Sydney. One scarf, not otherwise included in calculations, contained more than 450 µg/gm. The mean total quantity of allergen recovered in the 1-minute sampling period was 0.46 µg (0.266, 0.839). In the two items of clothing tested, the vacuumed dust samples contained only 0.041% and 1.07% of the total amount of allergen recovered by later extraction of the whole items. Live mites were recovered from 8 of the 15 samples by using the heat escape method; in these, the mean density of live mites was 8.6 (2.2, 34.0) per 100 cm², and one item exceeded 100 mites per 100 cm². The mean allergen level in items washed within the last month was 8.5 µg/gm (5.5, 13.1), which was significantly lower than items washed less frequently (27.1 µg/gm) (17.0, 43.1) (Fig. 1). The odds ratio for an allergen

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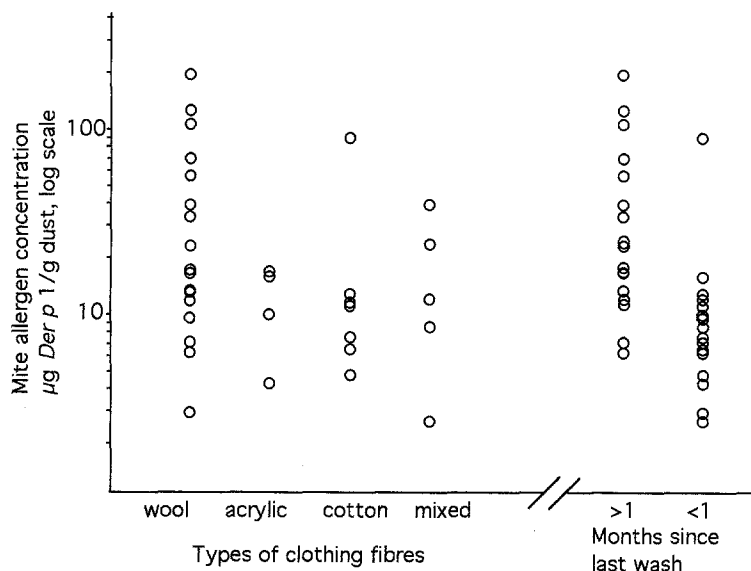


FIG. 1. Log of mite allergen concentration (micrograms of Der p 1 per gram of fine dust, log scale) shown for different types of clothing. Whether clothing had been washed in the last month is also indicated.

level greater than 10 µg/gm was 18.7 (2.8, 77.8) ($p < 0.001$) times greater in clothing not cleaned in the last month compared with more frequently washed or dry-cleaned clothing. The mean allergen level in woolen items was 21.0 µg/gm (11.6, 38.0), which was higher than the overall mean in other items (11.9 µg/gm) (7.8, 18.2). This higher level was found because woolen items were less frequently washed (e.g., suits, fine-quality pullovers, etc.) (tested for independent effects by analysis of variance). The risk for woolen clothing containing more than 10 µg/gm of allergen was 1.4 (0.4, 5.2) (not significant).

DISCUSSION

The results suggest that clothing has the potential to be a potent source of aeroallergen. Allergenic dust in such clothing has many opportunities to be disturbed by body movement, and the aeroallergens could be carried into the region of the face after they rise on thermal body drafts. The allergens found in clothes could come from many sources, including circulating aeroallergen in houses, allergens picked up when items were laid on furnishings, floors, and beds and could be produced directly by mites inhabiting these or adjacent items of clothing. At least half of the items tested contained live mites, and because only about 2% of surface area was sampled, the frequency of colonization may be higher. The observed density of mite population

was occasionally high, once exceeding 10,000 per square meter. Such high populations have been observed previously.² This is not unexpected because clothing is well supplied with moisture from condensed perspiration and with food from shed skin. House dust mites are highly mobile and are probably distributed to new niches by clothing.

Removing allergens and killing mites in clothing represents a challenge. Mites can be killed by hot washing ($>55^{\circ}\text{C}$) and by dry-cleaning. However, hot washing is unsuitable for some of the fabrics, and dry-cleaning does not elute the allergen Der p 1, although it removes dust.⁴ Cold aqueous washing of bedding removes more than 95% of the soluble mite allergen but not significant numbers of live mites.⁴ The development of cold-wash acaricides⁵ would seem to be a useful way to overcome this problem. Mites could also be killed by tumbling in a hot clothes dryer or by deep-freezing for more than 24 hours.

Physicians and patients allergic to mites should be aware that clothing is a potential source of mite allergen. Criteria for choosing clothing should recognize the need for regular washing, preferably in hot water. Clothes should be stored under dry conditions or be laundered after prolonged summer storage.

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Ciprofloxacin desensitization in a patient with cystic fibrosis

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Ciprofloxacin, a fluorinated quinolone, is a wide-spectrum antibiotic often used to treat patients with cystic fibrosis and known sputum isolates of *Pseudomonas* species. The advantage of ciprofloxacin is that it can be given orally, unlike other anti-*Pseudomonas* antibiotics generally used for the treatment of pulmonary exacerbations in these patients. Although it is generally well-tolerated,¹ anaphylactoid reactions with ciprofloxacin have been reported.²⁻⁴ A MEDLINE search revealed no reports of desensitization to ciprofloxacin. A successful case of desensitization to ciprofloxacin in a patient with cystic fibrosis is described.

CASE REPORT

The patient is a 15-year-old girl with cystic fibrosis who received ciprofloxacin for treatment of increased sputum production, fatigue, cough, and decline in pulmonary function. She had previously received a course of ciprofloxacin without complication. After the second day of the newly prescribed dose of 500 mg twice daily, urticaria developed over the scalp, face, and arms. There was no complaint of respiratory distress, swelling, or dizziness. Her other medications at the time of the reaction included nebulized albuterol and tobramycin, pancreatic enzymes, and multivitamins, all administered without any recent change in dose or formulation. Because the patient preferred treatment with an oral

TABLE I. Oral desensitization protocol for ciprofloxacin

Dose*	Concentration (mg/ml)	Amount (ml)	Dose (mg)	Cumulative dose (mg)
1	0.01	5.0	0.05	0.05
2	0.1	1.0	0.1	0.15
3	0.1	2.0	0.2	0.35
4	0.1	4.0	0.4	0.75
5	0.1	8.0	0.8	1.55
6	1.0	1.6	1.6	3.15
7	1.0	3.2	3.2	6.35
8	1.0	6.4	6.4	12.75
9	1.0	12.8	12.8	25.55
10	10.0	2.5	25.0	50.55
11	10.0	5.0	50.0	100.55
12	10.0	10.0	100.0	200.55
13	N/A	250 mg tablet		450.55

N/A, Not applicable.

*Doses were administered every 15 minutes.

antibiotic if possible, oral desensitization with ciprofloxacin was attempted.

Oral solutions for desensitization were prepared by initially dissolving a pulverized 250 mg tablet of ciprofloxacin in water to make a 10 mg/ml solution. Subsequent dilutions of 1.0 mg/ml, 0.1 mg/ml, and 0.01 mg/ml were made. Each solution was agitated just before use. Desensitization was performed in the morning with the protocol presented in Table I. Doses were administered every 15 minutes. Other than a complaint of bitter taste, no complications were noted. The patient was instructed to take the next oral dose of 500 mg that evening. The patient subsequently completed a

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