

New mattresses: how fast do they become a significant source of exposure to house dust mite allergens?

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Summary

Background Sensitization and exposure to mite allergens is a major risk factor for asthma. Little is known about the rate of build-up of allergens in the mite microhabitats.

Objectives To investigate the rate of increase in mite allergen levels in new mattresses.

Methods Der p 1 was measured in the dust samples collected from six identical new single mattresses over a period of 2 years.

Results Der p 1 increased significantly at 4 months as compared with baseline level ($P < 0.01$), but no difference was found between the concentrations at 4, 8, 12 and 24 months. There was a significant correlation between Der p 1 concentration in mattresses at 4, 8, 12 and 24 months and Der p 1 levels in the bedroom carpet at the beginning of the study.

Conclusions New mattresses can become a significant source of exposure to mite allergens after a short period of time (< 4 months). There is little justification for advising mite sensitive patients to replace their mattresses as a part of avoidance regime.

Keywords: house dust mites, exposure, mattress

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Introduction

Before house dust mites can be successfully controlled, it is necessary to know about mite dispersal and the rate of build-up of mite allergens in a household environment. Mite populations are found indoors in mattresses, upholstered furniture, on carpets and in clothing [1]. Suitable relative humidity and temperature in the microhabitat are essential for survival of a mite population [2]. However, even in the same geographical area, where the majority, if not all, of the houses have an indoor humidity level and temperature apparently suitable for mite population growth, there is still a marked difference in mite allergen levels between the houses [3]. Little is known about the rate of build-up of allergens in the mite microhabitats.

This study investigated the rate of increase in mite allergen levels in new mattresses.

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Methods

New mattresses, together with bed bases, were supplied directly from the manufacturer (Slumberland, Oldham, UK) to six different homes in the same area (south Manchester). All six were identical single mattresses and were delivered within the same week in December 1993. A single adult was sleeping in these beds throughout the study. Dust samples were collected by vacuuming the whole upper surface area of the mattress for 2 min at the beginning of the study (within 3 days of the delivery) and after 4, 8, 12 and 24 months. In addition, a 1 m² area of bedroom carpet was sampled after mattress dust was collected (to avoid cross-contamination) at the beginning of the study. Dust samples were collected using a Medivac dust sampler with an air-flow rate of 45 L/s through a 355 µm diameter mesh screen on to a 5 µm vinyl filter, thus enabling collection of fine dust samples. Der p 1 was measured by a two-site monoclonal antibody-based ELISA [4].

Table 1. Der p 1 levels (ng/g) in six mattresses over the period of 2 years, with corresponding concentrations in bedroom carpets at the beginning of the study

	Baseline	4 months	8 months	1 year	2 years	Carpet
1	<100	230	380	950	1250	1460
2	<100	320	330	2100	1000	1040
3	<100	<100	240	500	420	<100
4	400	4500	1140	1400	840	6500
5	500	2000	1200	2600	1760	3130
6	280	1950	2160	4150	3740	22500

Results

The types of domestic dwellings reflected the pattern of housing in the area (one flat, two terraced houses, two semi-detached houses and one detached house). All homes had central heating, and all bedrooms were fitted with wall-to-wall carpets.

Mite allergen levels in the dust collected from the mattresses at baseline and at 4, 8, 12 and 24 months are listed in Table 1. Also shown is the Der p 1 concentration in bedroom carpet dust at the beginning of the study. There was a rapid and significant increase in Der p 1 from mattress dust at 4 months ($P < 0.01$; log-transformed data, Student's *t*-test). Der p 1 levels at 8, 12 and 24 months were significantly higher than at baseline ($P < 0.01$), but no difference was found between the concentrations at 4, 8, 12 and 24 months ($P > 0.1$). There was a significant correlation between Der p 1 concentration in mattresses at 4, 8, 12 and 24 months and Der p 1 level in bedroom carpets at the beginning of the study (Fig. 1).

Discussion

When a population of dust mites colonizes a new mattress, the initial population grows rapidly until a certain size is reached. After this, the growth slows down until the upper limit is reached [5]. The population then fluctuates around this upper limit. In the group of six identical new mattresses there was a very rapid and significant increase in Der p 1 between baseline level and that at 4 months, but no difference was observed between the concentration at 4 months and those at 8, 12 and 24 months, respectively. A considerable difference in the rate of build-up of Der p 1 in mattresses between the homes was observed. In three of the homes the level of mite allergen in new mattresses

exceeded the proposed threshold for sensitization of 2000 ng/g [6] after a short period of time (up to 4 months). In contrast, in one house mattress Der p 1 remained very low even after 2 years. It is interesting that this was the house in which Der p 1 in the bedroom carpet was below the detection limit. Generally, a pattern emerged in which the homes with higher Der p 1 concentration in bedroom carpets were the ones with the fastest increase in Der p 1 in mattress dust. There was a significant correlation between the concentration of Der p 1 in mattress dust at all time points (4, 8, 12 and 24 months) and Der p 1 level in corresponding bedroom carpets at the start of study. This would indicate that the microenvironment in some homes is more conducive for mite population growth than in others, and this seems to apply for more than just one microhabitat (i.e. mattresses as well as carpets). The mite allergen levels in three of the mattresses studied were already elevated at the baseline (sampling was performed within 3 days of the delivery). We believe that the main reason for this finding was the circulation of mite aeroallergen from the carpets and its accumulation on the beds, as all three were the mattresses from bedrooms with the highest Der p 1 concentration in carpet dust. Since only six mattresses were tested, these results should be considered as noteworthy observations rather than definitive conclusions.

Patients are often advised to replace their mattresses as part of an avoidance regime. There seems to be little justification for this, as the new mattresses can become a significant reservoir of mite allergens even after a short period of time. The best advice to mite-allergic asthmatic patients regarding control of mite allergens in bed remains to use mite allergen impermeable bed covers (making sure that they are wiped once a week) and wash the bedding weekly in hot water.

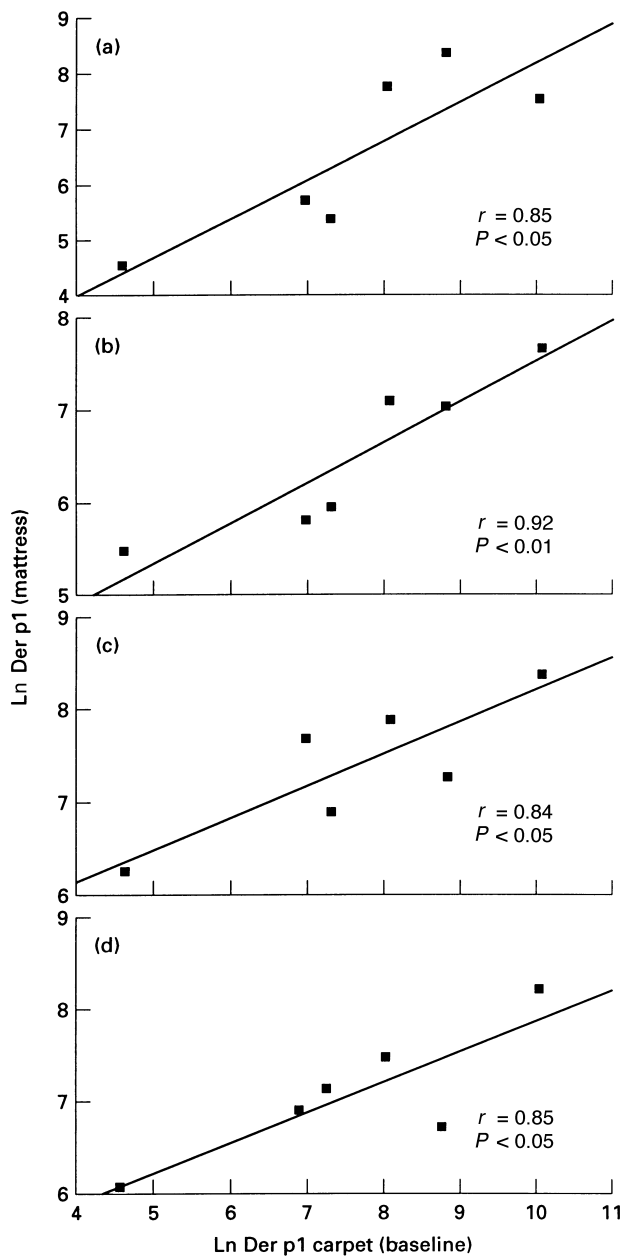


Fig. 1. Correlation of mite allergen Der p 1 (ng/g) in six new mattresses at (a) 4, (b) 8, (c) 12 and (d) 24 months, and Der p 1 level in the bedroom carpet at the beginning of the study.

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