

December 1994, part 1 • Volume 94 • Number 6

House dust mite allergen import into a naturally mite-free environment

Martin Walliser, MD [\[MEDLINE LOOKUP\]](#)

Beda M. Stadler, PhD [\[MEDLINE LOOKUP\]](#)

- *Bern, Switzerland*

Sections

- [Methods](#)
- [Results](#)
- [Discussion](#)
- [References](#)
- [Publishing and Reprint Information](#)

HDM House dust mite

The importance of house dust mites (HDMs) in the pathogenesis of house dust allergy and asthma is well established. Several studies on allergen avoidance have demonstrated significant clinical benefits if methods likely to produce substantial reduction of allergen exposure in houses have been applied.¹

Alpine regions higher than 1700 m above sea level can be regarded as naturally mite-free environments. HDMs are not able to survive at such altitudes, mainly because of a very low relative humidity during most of the year and temperatures far below 0° C during 4 to 6 months of the year. We investigated dust from mattresses in Swiss Alpine Club huts at altitudes of up to 3250 m in the region around the Matterhorn. Sampling in alpine areas, and for comparison in lower lying regions, was performed during the same time, September to December 1991.

We found a decrease of antigen overall with increasing altitude. Interestingly, the decrease of allergen was clearer, especially in altitudes above 1700 m.

Methods

For dust collection, we used a hand-held vacuum cleaner, additionally equipped with rechargeable accu-cells. The device was modified to accept a removable ALK disk filter holder and disk filters. As practiced by other authors, we vacuumed 1 m² of mattress surface for 1 minute.²

Dust extraction was effectuated as described by Twiggs et al.³ Total protein content of every sample was measured by a commercial protein assay (BioRad Protein Assay; Bio-Rad Laboratories, Wertheim, Germany).

Rabbits were immunized with HDM feces (kindly provided by Dr. E. Bischof, Kirchheim, Germany). The IgG fraction of the rabbit antiserum was labeled with peroxidase and used to perform a dot sandwich assay as described previously.⁴

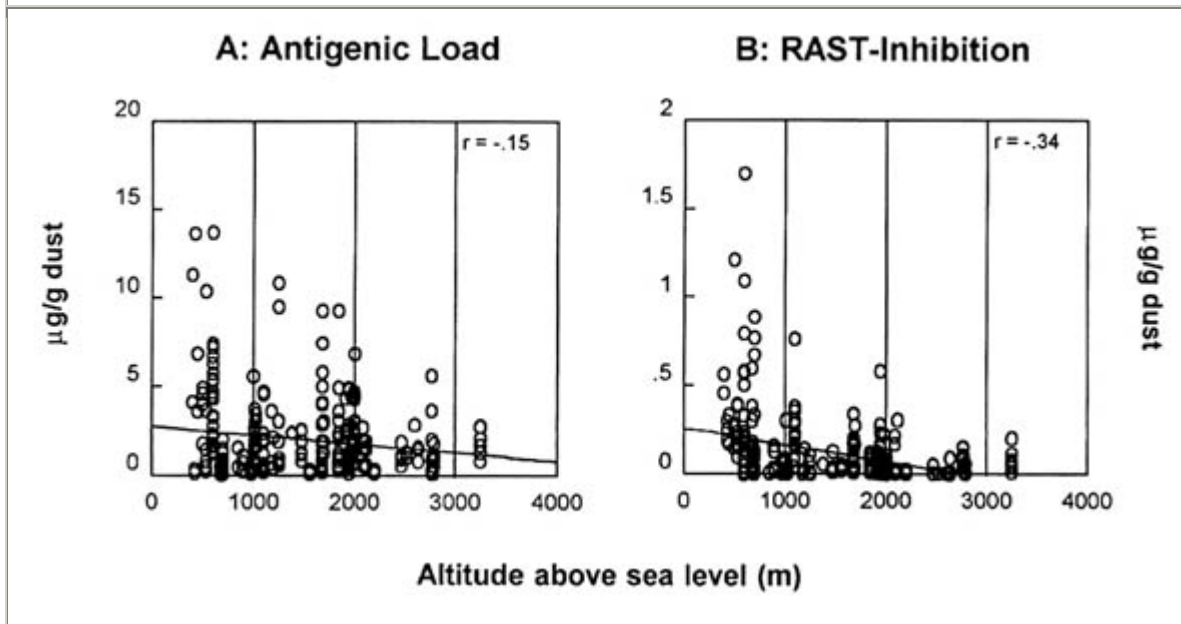
To estimate allergen content of dust, a human IgE-positive serum pool, consisting of sera from 54 patients with documented allergy to *Der p 1* and *Der f 1*, was used. House dust extracts were used to inhibit IgE binding of the positive serum pool to *Der p 1*, D1-disks and *Der f 1*, D2-disks (Stallergènes, Frèsnes, France) in a RAST inhibition assay. A standard curve was constructed by using an HDM extract (provided by Allergopharma, Basel, Switzerland), which contained 1850 µg of mite feces per milliliter, to quantify results.

Results

The total of 269 dust samples consisted of 155 samples from altitudes below 1700 m and 114 samples from altitudes higher than 1700 m including 30 samples of altitudes above the vegetation line (2700 m). Because we practiced a standardized sampling, we compared weight and protein content of all samples. Dust weight ranged between 6 mg and 1176 mg. A slight increase of dust weight with increasing altitude was observed ($r = 0.27$). Dust weight and protein content showed a relatively good correlation ($r = 0.51$).

Results of the dot immunobinding assay are shown in Fig. 1, A. A great interhome variability was detected, as found by other authors before. A marginal decrease of antigenic mite products with increasing altitude was found ($r = 0.15$), and the highest levels were found below 1500 m. Results of the RAST inhibition assay are shown in Fig. 1, B. Interestingly, the decrease of allergen levels was more significant ($r = 0.34$) than the antigenic decrease.

FIG. 1. Antigenic and allergenic load of dust samples in relation to altitude above sea level (in meters). **A**, Antigenic components, determined by a sandwich dot immunobinding assay. **B**, Allergenic components, determined by a RAST inhibition assay.



Samples from regions above 1700 m and below 1700 m were grouped to determine whether altitude was the principal determinant of antigen or allergen level. Below 1700 m, we found an increase in antigen and allergen contamination with increasing humidity, temperature, and age of the mattress. Lower hygienic standards, assessed by the frequency of using beds or the time since last cleaning, also increased antigen and allergen levels. Similar results were also obtained from samples above 1700 m (data not shown).

Nevertheless, it can be stated that our observed differences are not due to a single parameter and that altitudes above 1700 m can serve as a model for mite-free living space of normal to low hygienic standards, namely where antigenic and allergenic components are imported to a higher degree than into normal inhabited houses and where they remain because of a lower hygienic standard.

Discussion

Controlling exposure to allergens is a primary component of any strategy to manage allergic diseases. This study was undertaken to show the effect of import and accumulation of HDM allergens into an environment where mites cannot grow. There are studies documenting allergen import into environments with normal domestic conditions,² but we wanted to investigate a natural environment where mites can only be imported and does not represent a normal living space for them.

We showed in this study that antigenic and allergenic mite components in general can be detected at altitudes of up to 3250 m, although at low and probably clinically irrelevant levels. We assume that the imported living mites probably die rapidly and are not able to produce significant amounts of allergens. This assumption has been proposed by other authors⁵ but has not been determined for mite allergens by immunochemical methods.

High alpine huts offer an environment less favorable for mite growth than a well-cleaned home. However, low hygienic standards such as infrequent cleaning and sleeping in mountaineer clothes may favor an accumulation of HDM components to a greater degree than in a sanitized home. On the other hand, unfavorable life conditions prevent growth and reproduction of mites, and thus production of allergens. On the basis of our results, one can assume that mite import into a sanitized environment only becomes important if mites find favorable living conditions.

References

1. Platts-Mills TAE, Thomas WR, Aalberse RC, Vervloet D, Chapman MD. Dust mite allergens and asthma: report of a second international workshop. *J ALLERGY CLIN IMMUNOL* 1992;89:1046-60.
2. International Workshop, Platts-Mills TAE, de Weck AL. Dust mite allergens and asthma — a worldwide problem. *J ALLERGY CLIN IMMUNOL* 1989;83:416-27.
3. Twiggs JT, Gray RL, DeJongh S, Marx JJ. *Dermatophagoides farinae* allergen levels from two different sources within the same home: evaluation of two different collection techniques. *Ann Allergy* 1991;66:431-5.
4. Hong CS, Stadler BM, Wälti M, De Weck AL. Dot immunobinding assay with monoclonal anti IgE antibodies for the detection and quantitation of human IgE. *J Immunol Methods* 1986;95:195-202.
5. Spieksma FTHM, Zuidema P, Leupen MJ. High altitude and house-dust mites. *Br Med J* 1971;1:82-4.

Publishing and Reprint Information

- From the Institute of Clinical Immunology, Inselspital, University of Bern.
- Reprint requests: Beda M. Stadler, Institute of Clinical Immunology, Inselspital, CH-3010 Bern, Switzerland.
- *J ALLERGY CLIN IMMUNOL* 1994;94:1073-4.
- Copyright © 1994 by Mosby—Year Book, Inc.
- **1/54/58633**