

Controlled trial of house dust mite avoidance in children with mild to moderate asthma

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Summary

Twenty-six asthmatic children participated in a controlled trial of house dust mite avoidance. Group A ($n=14$) had 12 weeks' avoidance, provided that they had not deteriorated at the end of the first 6 weeks. Group B ($n=12$) had an initial 6 weeks' observation period followed by 6 weeks' avoidance. Mite numbers were extremely variable and often low. There was a significant fall in mite numbers in the first, but not the second, 6-week period in group A. In group B there was a significant fall in mite numbers in both the first (observation) and second (active avoidance) periods. Active avoidance produced highly significant falls in total serum IgE. There were no significant changes in IgE during the observation period. This impressive immunological effect was not associated with any changes in the radio-allergo-sorbent assay (RAST) to house dust mite, or symptom scores; peak expiratory flow rates or histamine induced bronchial reactivity. More rigorous avoidance procedures in more severely affected asthmatic patients warrants further investigation.

Introduction

Up to 85% of children with asthma will have a positive skin test to the house dust mite (*Dermatophagoides pteronyssinus*) [1] and bronchial provocation tests to house dust mite extract are frequently positive [2], suggesting that house dust mite allergy may be important in the pathogenesis of childhood asthma. Bronchial responsiveness to inhaled allergen is related to both skin sensitivity and non-allergic bronchial responsiveness [3,4]. In occupational asthma allergen avoidance can reduce bronchial hyperreactivity [5] and if mite avoidance were effective we might expect clinical benefit and reduced bronchial hyperreactivity as has been described in two previous studies [6,7].

Trials of mite avoidance in childhood asthma are few and have conflicting results. Sarsfield and colleagues reported significant clinical improvement in fourteen children

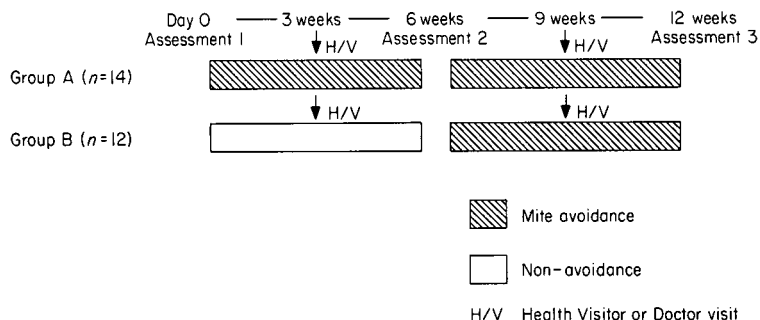


Fig. 1. Study design. Treatment is with salbutamol rotahaler p.r.n.

treated with mite avoidance but there was no control group [8]. Other trials did not show significant clinical benefit [9,10] but, unlike Sarsfield, they did not use an all-enclosed mattress cover. A recent Canadian study demonstrated substantial reductions in bronchial hyperreactivity and medication requirements in ten children carrying out mite avoidance measures compared with a control group [6]. The regime was stringent and including removing carpets, sealing ducted hot air heating and removing animals from the house if the child was skin-prick test positive to them.

The present study was undertaken to determine whether the Canadian results could be reproduced with the routine mite avoidance measures as recommended in many U.K. clinics and to investigate any immunological changes that might occur during avoidance.

Subjects and methods

Twenty-six children (aged 6–16 years) with mild to moderate asthma participated. Ethical Committee approval was obtained in both health districts. No child had received mite avoidance prior to the study and none was on regular drug prophylaxis, their asthma medication being bronchodilators as required. We chose to study children with mild to moderate asthma as they represent a numerically important group who are often given treatment in the form of mite avoidance before drug prophylaxis is considered.

Parental consent was obtained in all cases. A summary of the trial protocol is shown in Fig. 1. Following clinical assessment (DRNG or JKS) the children were skin tested using the prick method with Bencard commercial extracts to *D. pteronyssinus*, house dust, cat, dog and any other allergen thought to be relevant. Blood was taken for total serum IgE and a radio-allergo-sorbent test (RAST) of specific IgE to the same antigens as tested on the skin. The RAST was graded from 0 (negative) to 4 (strongly positive). In addition a histamine challenge test was performed before randomization. Mite counts, total serum IgE, RAST tests and histamine challenge were performed at 0, 6 and 12 weeks.

Mite counts

Counts were taken from the upper surface of the mattress using a standard brushing technique. The resulting dust was incubated in lactic acid and counts expressed as mites/m² of mattress area. Dust was obtained by either a health visitor or doctor (DRNG).

Mite avoidance measures

Avoidance measures as used by Sarsfield [8] were restricted to the bedroom and included the use of an all-enclosing mattress cover. The pillow was enclosed in a plastic cover and soft toys were excluded from the bedroom, as were pets. Synthetic bedding was employed and weekly damp dusting undertaken. In addition, thorough vacuuming of the bed, mattress and bed base were considered an essential measure.

Diary cards

Diary cards recorded day and night cough and wheeze, daytime activity, medication requirements, and twice daily peak flow rates.

Histamine challenge test

This investigation measured baseline airways hyperreactivity and was repeated at 6 and 12 weeks. The test was performed at approximately the same time of day on each occasion and utilized the basic methodology of Cockcroft *et al* [11]. The output of a Wrights nebulizer was adjusted to 0.13–0.16 ml/min. Inhalation with phosphate buffered saline was given for 2 min and peak flow measured at 30 and 90 sec post inhalation. Thereafter, doubling concentrations of histamine to a maximum of 8 mg/ml were administered until there was a 20%, or greater, fall in peak flow rate compared to baseline. The provocation concentration 20% (PC₂₀) was recorded.

Serum IgE

Serum IgE was measured using the Phadebas IgE PRIST method. Measurements were performed within a week of venepuncture. All assays were undertaken at St James's University Hospital.

Home visits

Prior to the commencement of the study a health visitor or doctor visited the home to obtain a sample of mattress dust. If in group A, the family was instructed in the technique of mite avoidance; if in group B, the family were told to continue with their normal domestic cleaning practice. All homes were visited at 3 weeks to ensure that avoidance was being carried out in group A but not group B and that diary cards were being kept correctly. Visits were also made at 6 and 12 weeks to collect dust and at 9 weeks in both groups to ensure that avoidance was being carried out.

Study timing

In order to minimize any effects due to pollen sensitivity the study ran from November to the middle of April.

Results

The principal statistical methodology employed analysis of variance together with multiple regression analysis.

One child in group A was removed from the trial after a few days as his asthma deteriorated rapidly. He required drug prophylaxis and was not included in the final analysis.

Sample characteristics

The children were well matched as shown in Table 1. All had a greater than 2-mm weal on skin testing to house dust mite.

Table 1. Sample characteristics of patients in group A (mite avoidance for 12 weeks) and group B (observation during the first 6 weeks)

Patient characteristics	Group A	Group B
Number	13	12
Age mean	9.92	9.42
Skin test HDM (weal diameter in mm) mean	4.15	4.92
Grade RAST to HDM mean	2.85	2.50

Mite counts

There was a large range of counts (0–228 total mites) and counts were often low. Most children slept on comparatively new mattresses and only seven slept on mattresses over 3 years old. There was significant fall in mite numbers in the first 6 weeks in group A ($P < 0.005$) but not in the second 6 weeks. In group B there was a significant fall in mite numbers in both the first 6 weeks ($P < 0.001$) and the second 6 weeks ($P < 0.005$) as summarized in Table 2.

Total serum IgE

All periods of avoidance produced a highly significant fall in total serum IgE when compared with control ($P < 0.005$). Table 3. Four children in the study had mild eczema and one moderate eczema. Only one of the children with eczema experienced a significant fall in IgE with avoidance. Changes in IgE are only significant in those children with a high degree of sensitivity to the house dust mite as judged by above average skin test and RAST test ($P < 0.001$).

Histamine challenge

Bronchial reactivity in this group of childhood asthmatics was, as expected, only moderately increased. There were no significant changes in bronchial reactivity during the trial. Table 4.

RASTs, symptom scores, medication requirements, peak expiratory flow rates

There were no significant changes in any of the above parameters during the course of the trial. Any changes that did occur were not related to reduction in mattress mite counts or mite sensitivity.

Table 2. Means (standard deviations) of house dust mites/m² recorded for mattress surfaces

House dust mite counts			
	0	6/52	12/52
Group A	40.00 (64.24)	1.23 (1.74)	0.85 (1.07)
Group B	21.75 (20.30)	10.33 (16.22)	2.17 (4.57)

Table 3. Mean total serum IgE (standard deviations)

		Serum IgE		
		0	6/52	12/52
All children	Group A (<i>n</i> = 13)	291.31 (331.66)	205.77 (191.09)	213.54 (189.29)
	Group B (<i>n</i> = 12)	586.64 (406.84)	596.09 (416.07)	288.00 (248.47)
Children with HDM skin test and RAST above average	Group A (<i>n</i> = 9)	379.33 (366.67)	221.88 (193.89)	239.33 (208.59)
	Group B (<i>n</i> = 7)	646.71 (372.24)	638.57 (360.39)	325.00 (244.87)
Children with HDM skin test and RAST below average	Group A (<i>n</i> = 4)	93.25 (76.99)	169.50 (208.02)	155.50 (144.24)
	Group B (<i>n</i> = 4)	481.50 (501.45)	521.75 (552.91)	223.25 (277.65)

Table 4. Means of PC₂₀ (standard deviations), concentration of histamine mg/ml

		Bronchial reactivity		
		0	6/25	12/52
Group A	4.20 (3.28)	4.91 (3.18)	5.03 (3.07)	
Group B	2.90 (2.72)	3.86 (2.52)	3.30 (3.02)	

Discussion

Complete eradication of the house dust mite and its products is impossible [12]. However, mite avoidance measures aim to reduce the mite population and allergen exposure to reduce symptoms. Exposure to ragweed pollen can cause increased non-allergic bronchial responsiveness and symptoms of asthma [13]. If mite allergy was important in the pathogenesis of childhood asthma, reduced exposure should improve symptoms. Reductions in bronchial hyperreactivity during prolonged mite avoidance have been demonstrated in adults and children [6,7]. This was not shown in the present study. Trigger factors in childhood asthma include not only allergens but also cold air, viral infections, emotion and exercise. The importance of each precipitant varies from patient to patient and this may help to explain differing responses to allergen avoidance.

House dust mite avoidance is commonly recommended in children with mild to moderate asthma with the expectation that the need for drug prophylaxis can be minimized or avoided altogether. Although we have demonstrated a significant immunological effect with mite avoidance, we have been unable to demonstrate any significant clinical improvement using standard avoidance measures. More stringent measures such as removing carpets and curtains would be unacceptable to parents of children with mild to moderate asthma.

Mite counts were often low from the mattresses of our patients and the general standards of cleanliness were high. This may have made an effect more difficult to achieve. We postulate that there was a significant reduction in mite numbers in the control group because the presence of a medical person sampling the mattress inevitably led to increased attention to cleanliness in the home and, in particular, the bedroom.

The data on serum IgE shows that mite avoidance over and above simple cleanliness produces a highly significant reduction in IgE. The reasons for the reduction in IgE are unclear. Perhaps house dust acts as an adjuvant to the IgE production or perhaps the avoidance procedures removed exposure to another unidentified allergen. Certainly, the falls in IgE were only significant in those children who reacted most positively on skin testing and RAST to the house dust mite, so we must postulate that the phenomenon is closely related to the degree of mite sensitivity as estimated by these investigations.

It has been suggested that prolonged avoidance of the house dust mite is necessary to produce a beneficial clinical effect [7,14], although stringent avoidance has been reported to produce short term effects [6]. Mite avoidance, for a period of up to 12 weeks in the present study, produced a significant immunological effects but this was not associated with changes in the RASTs to house dust mite, symptom scores, peak flow rates or changes in bronchial hyperreactivity.

This study has failed to show clinical benefit from house dust mite avoidance in children with mild to moderate asthma, but has demonstrated a significant fall in total serum IgE with active treatment. Future studies should evaluate clinical and immunological changes using standard mite avoidance procedures over a more prolonged period than that used in the present study. Stricter regimes of avoidance also warrant further study.

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