

THE EFFECTS OF REDUCING THE MITE ALLERGEN LEVELS IN THE RESIDENCES OF BRONCHIAL ASTHMATIC CHILDREN

MITSUGU MOTOKI^{1,2}, TETSUYA TAKAMASU^{3,4}, AND RIKUO DOI²

¹Apex Pest Control, 23-4, 2-Chome, Shiba, Minato-ku, Tokyo, Japan,

²Department of Hygiene, Yokohama City University, School of Medicine, Fukuura, Kanazawa-ku, Yokohama-shi, Kanagawa-ken, Japan, ³Department of Parasitology, Yokohama City University, School of Medicine, 3-9, Fukuura, Kanazawa-ku, Yokohama-shi, Kanagawa-ken, Japan ⁴Department of Pediatrics, Hitachi Totsuka General Hospital, 550, Totsuka-Cho, Totsuka-ku, Yokohama-shi, Kanagawa-ken, Japan

Abstract - Mite allergens in a house are considered to sensitize the residents at levels more than 2µg/g fine dust and may cause bronchial asthma at the level over 10 µg/g. The floor materials were substituted to cork and the bedding to mite-free one, and reduction of mite allergens and improvement of the symptoms and signs of bronchial asthma were observed in two houses where there are children with bronchial asthma. Mite allergens were measured in the houses of the children who have been receiving medical treatments for bronchial asthma. Dust samples were collected from the bedding and flooring of their houses before and after the substitution of the flooring and bedding. Mite allergen level was over 10µg/g fine dust in both houses before substitution. The bedding was changed to allergen free bedding and the flooring was substituted from tatami to cork in both houses. The changes of mite allergens in the house, symptoms of asthma, a peak expiratory flow and eosinophils in peripheral blood of the patients were compared before and afterward. A sharp reduction of mite allergen level was shown after the substitution, and the levels were kept under sensitization risk level (2 µg/g fine dust) thereafter. Feedback from the families showed that cork floors were easy to clean and to be a comfortable substitute. After the substitution of bedding, the allergen levels in the residences decreased to 1 / 84 in Family A and 1/ 215 in Family B at peak levels. Eosinophils in peripheral blood decreased in 3 months from 2,032 to 273 /µl (case A-1), 1498 to 450 /µl (case A-2) and 762 to 321 /µl (case B-1). In B-1 case, peak expiratory flow was also improved after the substitution. It was confirmed that substitution of floor materials and bedding could reduce mite allergens in the house and improve bronchial asthma of the residents.

Key words - Mite, tatami, bedding, dust

INTRODUCTION

It is widely recognized that mite allergens may cause bronchial asthma. Two sets of major allergens from mites of the genus *Dermatophagoides* are now well known (Voorhorst *et al.*, 1967; Miyamoto *et al.*, 1968; Ishii *et al.*, 1979). These mites are cosmopolitan in any house dusts. The primary food source of mites appears to be skin scales and fungi growing on skin scales (World Health Organization, 1988). Consequently, the largest number of dust mites are usually found in bedding, carpeting, tatami mats and upholstered furniture, where mite allergens are accumulated. In developed countries, there have been several changes in construction and furnishing of houses which would favor mite proliferation. These include (a) spread of air-conditioners, so that rooms are maintained at a temperature conducive to mite growth; (b) reduced ventilation and air-tightness of the house especially in modern building increases the indoor humidity; (c) global warming induced by the greenhouse effect.

It is well-known that not only live mites but also mite's carcasses and feces are major source of house dust allergens (Tovey *et al.*, 1981; Platts-Mills and Chapman, 1987). But, vacuum cleaning of floors impose greater burdens to home owners. Beside, intensive cleaning does not give greater benefit. Our study shows that the improvement of bedding and flooring, especially of the bedding, can effectively reduce mite allergens and improve the symptoms of asthma.

MATERIALS AND METHODS

Family A

Family A is constituted of parents, a daughter and 3 sons. Among them, the daughter (10 years old) and the eldest son (13 years old) have bronchial asthma due to mite allergens. Their house has 2 stories and

4 rooms in all. Two rooms (12.4 m², 9.9 m²) were covered with tatami mats and had been used as the bedrooms for the children. Tatami was substituted to cork floors in both tatami rooms. At the same time, the bedding was changed to allergen free bedding (Yamasei Co.) which is made by mite-free cotton and heated to kill mites before distributing. Due to the high fabric density (0.05 mm in diameter), it can not be penetrated by mites or their carcasses and feces. Bedding of all family members were also changed because their mite allergen levels may influence the patients.

Family B

Family B is consisted of parents and two sons. The elder son (7 years old) has bronchial asthma due to mite allergens. Their house is an apartment on the forth floor of a 4 story building. There are 2 tatami rooms (9.9 m², 7.5 m²), one for dining and bedroom for the parents and the other is used for children's bed room. All tatami rooms were changed to cork floor. The bedding was changed to allergen free bedding (Yamasei Co.) the same as Family A.

Collecting, processing dust samples, measuring mite allergens

Vacuum cleaners were used for collecting dust samples, and they were equipped with a special attachment to collect dust on a paper filter. Sampling time was 5 minutes for the entire bedroom and living room and 5 minutes for bedding (1 m²). The samples were collected before the installation of cork floors and once a month after installation. Dust samples were kept in their refrigerators for more than a half day and sent to a laboratory (LCD Co.) for inspection. Mite allergens were measured by the method of Enzyme-linked immunosorbent assay (ELISA) using mouse monoclonal antibodies (Yasueda, Mita, Yui and Shida, 1989). The allergens *Der p1* and *Der f1* were measured. We used the allergens *Der 1* (total of *Der p1* and *Der f1*) for assessing the mite allergen levels in houses.

RESULTS

Family A (Figure 1)

Mite allergen (*Der I*) from third brother's bedding was 43 µg/g fine dust in September. Any time before changing to mite free bedding, the values were over 10 µg/g. After the improvement, the value has become under 2 µg/g. The value from daughter's bedding was also over 10 µg/g before changing, and it was improved to almost under 2 µg/g. The tatami rooms of first and second floors, before changing to cork, were not so high and controlled to almost under 2 µg/g.

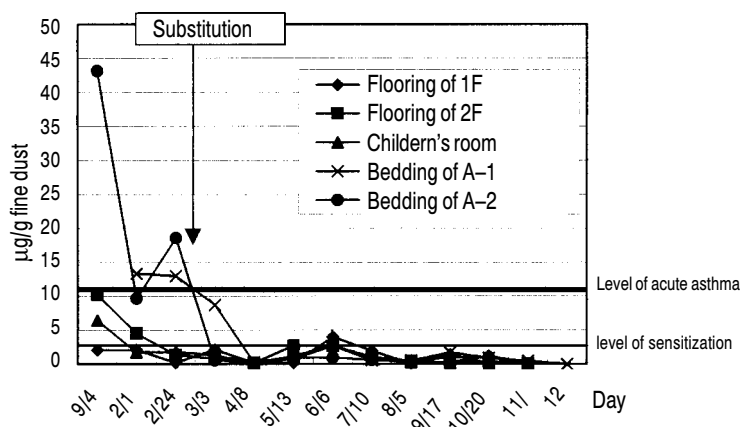


Figure 1. The transition of mite allergen in family "A".

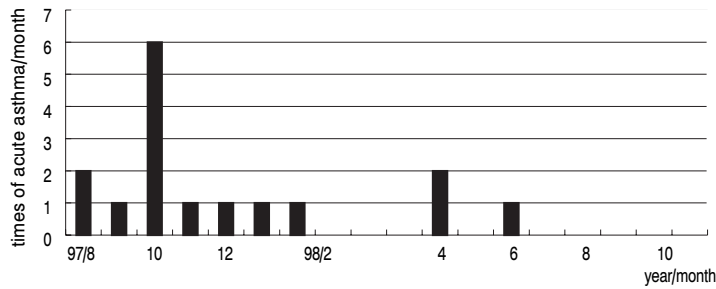


Figure 2. Times of acute attack of asthma on patient „A-1“.

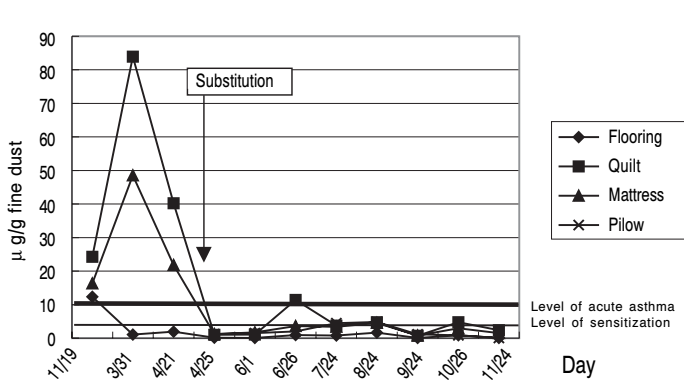


Figure 3. The transition of mite allergen in family „B“.

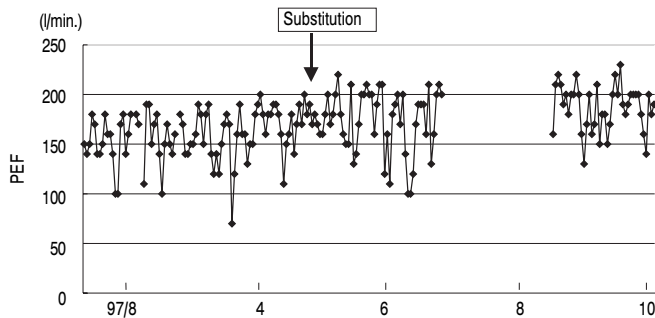


Figure 4. Peak expiratory flow of patient „B-1“.

Case A-1 (Figure 2)

This 10-year old girl takes oral slow-release theophylline twice a day as a controller and oral procaterol as a reliever only when she had acute attack of asthma. Before the improvement, she had acute attacks every month. After the improvement, her symptoms have been better, especially since August she has had no acute attacks. Her peripheral eosinophils has decreased from 2,032 /µl to 273 /µl. Specific IgE antibodies to *Dermatophagoides pteronyssinus* have been more than 100 U/ml invariably throughout the year.

Case A-2

The 13 years old boy has asthma which was often provoked by exercise. Therefore, he usually inhales DSCG (disodium cromoglicate) before exercise. After application of allergen-specific preventive meas-

Table 1. Symptoms and medication of patients.

Family Name	“A”		“B”
PatientsA-1 (10 years old girl)	A-2 (13 years old boy)	B-1 (7 years old boy)	
Acute attacks of asthma	Almost disappeared	Disappeared	Tendency of decrease
peak expiratory flow	—	—	improved
Eosinophils	2032→273/ μ l	1498→450/ μ l	762→321/ μ l
Specific <i>Dermatophagoides pteronyssinus</i> IgE antibodies	>100→>100 U/ml	88.2→96.7 U/ml	53.3→52.8 U/ml
Medical treatments	<ul style="list-style-type: none"> ● Oral slow-release theophylline ● oral procaterol 	<ul style="list-style-type: none"> ● Inhaled DSCG (disodim cromoglicate) 	<ul style="list-style-type: none"> ● oral slow-release theophylline ● oral procaterol ● Inhaled DSCG ● Inhaled salbutamol

ures, his symptoms of exercise induced asthma have disappeared. His peripheral eosinophils has decreased from 1,498 / μ l to 450 / μ l, but specific IgE antibodies have slightly increased.

Family B (Figure 3)

Mite allergen (*Der I*) of patient's bedding was 83 and 48 μ g/g fine dust in March. After changing to mite free bedding, the values decreased to under 2 μ g/g. But in June, it surged to over 10 μ g/g because of contamination from old summer bedding. After April the value had been kept under 5 μ g/g. On the other hand, floors had not been so high value (about 10 μ g/g) before substitution, and after changed to cork, have been controlled under 2 μ g/g.

Case B-1 (Figure 4)

The 7 year old boy usually takes oral slow-release theophylline every 12 hours, procaterol, inhaled DSCG and salbutamol twice a day as a controller to prevent acute attacks. We monitored his peak expiratory flow (PEF) using a portable peak flow meter, and it has been improved from 100 to 200 l/min. His peripheral eosinophils has decreased from 762 / μ l to 321 / μ l. IgE antibodies have been almost the same as before the treatment.

DISCUSSION

WHO suggests to reduce mite allergen levels by tenfold or more and recommends provisional standards for both of sensitization to mites and mite allergen exposure. WHO proposed 2 μ g *Der p I* /g of dust (equivalent to 100 mites/g or 0.6 mg guanine /g of dust) as the risk level for sensitization and the development of asthma. The levels higher than 10 μ g *Der p I* /g of dust (or 500 mites /g of dust) are proposed as the major risk factor for the development of acute asthma in mite allergic individuals. In order to reduce mite allergens in houses, cork floors were installed and bedding was substituted to mite free one in this study. Cork floor was chosen for floor material because of comfort and easy to clean. During the study period, cork floors were kept mostly under 2 μ g *Der p I* /g of fine dust.

Bedding was changed to one made of high density fabric. In our previous study, mite allergens had increased in mite-free bedding within a 6 month period. This study showed that mite allergens have not increased more than 5 µg *Der p* I/g of fine dust except one site which seemed to be contaminated from old bedding. The patients have improved their symptoms. It was confirmed that application of cork floor materials and mite-free bedding could reduce mite allergens in the house and improve bronchial asthma of the residents.

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