

Asthma, mite sensitization, and sleeping in bunks

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Background: Mattresses and bedding are the main reservoirs of house dust mites.

Objective: Subjects sleeping in the bottom bunk may be exposed to house dust particles detached from bedding of the top bunk. Our aim was to ascertain whether this exposure could influence the development of mite sensitization and/or allergic symptoms in these individuals.

Methods: Symptoms of allergic respiratory disease were recorded and mite skin tests performed in 94 consecutive bunk-sleeping subjects (47 pairs of siblings) from an outpatient allergy clinic. Levels of Der p I, Der f I, and Der II were determined by enzyme-immunoassay in 16 randomly selected bedding dust samples (8 pairs of bunks).

Results: Mite sensitization rate and prevalence of allergic respiratory disease were similar for the top-bed and bottom-bed groups, whereas prevalence of asthma was significantly higher in the latter. Mite sensitization was significantly associated with family atopy background, whereas other factors such as house pets, indoor smoke exposure or types of mattress or bunks were not. Der p I levels higher than 2 $\mu\text{g/g}$ dust were found in 12 of the 16 mattresses and the median of the 8-bed-bottom group was over 10 $\mu\text{g/g}$.

Conclusions: Sleeping in bunks constitutes a greater risk of developing asthma for subjects sleeping in the bottom bed. Bunk sleeping should be discouraged in families with an atopic background and sensitized subjects should use the top bed.

Ann Allergy Asthma Immunol 1999;82:531-533.

INTRODUCTION

The importance of house dust mites as aeroallergens causing respiratory allergy is well known.¹ Mattresses and bedding are one of the main reservoirs of house dust mites.^{2,3} The level of exposure is determined by multiple domestic factors, one of which may be the use of bunks, where subjects sleeping in the bottom bed may be exposed for many hours to particles of house dust released from the top-bunk bedding owing to movements of the top subject during sleep. The aim of the present study was to ascertain whether the bottom position in a double-bed bunk could increase the possibility of

mite sensitization, and/or development of mite allergic rhinitis or asthma.

PATIENTS AND METHODS

Study subjects were recruited from consecutive patients attending an outpatient allergy clinic. Patients who had been sharing a bunk with a sibling for more than 6 months, occupying always the same position (top or bottom) on the bunk, were selected. Siblings were chosen to avoid differences in genetic atopy predisposition. The study group was composed of 94 subjects, corresponding to 47 pairs of siblings.

Clinical history including family atopy background, exposure to indoor smoking, exposure to house pets and current allergy symptoms (rhinitis or asthma) were recorded together with age at starting to sleep in a bunk, duration of bunk use, bunk-bed position (top or bottom), type of bunk used (parallel or crossed), and the nature of

mattresses and pillow stuffing materials (wool, foam, or spring-mattress).

Skin prick tests with the two main species of mites in our area⁴ (*Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*) (ALK Abelló, Madrid, Spain) were performed with standardized lancets (DHS Bayer, Valdemoro, Spain), using histamine chloride 10 mg/mL and saline as controls. The tests were considered positive when the skin wheal diameter to at least one of the two mites was 3 mm larger than the one caused by diluent control.

A sample of house dust from eight randomly selected bunks (16 beds) of study subjects was obtained to analyze mite allergen content. Subjects were instructed to vacuum clean the top and bottom bedding of the bunk for 10 minutes and collect each sample in separate unused bags, as previously described by Ventas et al.⁵ The procedure was carried out during January 1998. Der p I, Der f I, and Der f II levels were quantified by a commercial enzyme-immunoassay using monoclonal antibodies (DEA-Test, ALK-Abelló, Madrid, Spain).

Descriptive analysis was performed using absolute and relative frequencies for categorical variables and mean and standard deviation for quantitative variables. Bivariate analysis was performed using the chi-square test for categorical variables and the ANOVA test for quantitative variables. Differences between allergen concentrations in dust samples were studied using the Mann-Whitney U test. The level of statistical significance was established at $P \leq .05$. Statistical analysis was performed using the SPSS statistical package.

RESULTS

No differences were found between top-bed and bottom-bed-sleeping sub-

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Received for publication October 1, 1998.

Accepted for publication in revised form February 1, 1999.

jects regarding sex, age, age at beginning to sleep in a bunk, length of time using the bunk, positive skin tests to mites or presence of respiratory allergy diseases (Table 1). Nevertheless, asthma was more prevalent in subjects sleeping on the bottom bed than those sleeping on the top bed (Table 1).

Positive skin tests were associated only with family atopic background and presence of asthma and/or allergic rhinitis, and were not associated with either exposure to pets, indoor smoking, type of bunks used, or mattress or pillow stuffing material (Table 2). No wool material was present in bedding, with the exception of eight subjects who used wool-stuffed pillows.

Allergen levels in the 16 house dust samples are shown in Table 3. Der p I was found in all samples and levels were higher than 2 $\mu\text{g/g}$ dust in 12 of 16. Extremely high Der p I levels were found in one of the bunks (140 $\mu\text{g/g}$ in the top-bed and 562 $\mu\text{g/g}$ in the bottom-bed). No Der f I was found in these two samples, a fact already mentioned by Fernández-Caldas,⁶ who suggested that the absolute predominance of one species leads to the disappearance of the others. Although Der p I levels were higher in the bottom than the top bed in seven of the eight bunks, no significant differences were found between the two groups for the allergens studied (Table 3).

DISCUSSION

Mattresses, carpets, and fitted carpets are the main sources of house dust mites. In atopic families, early exposure to high levels of mite allergens has been related to the development of bronchial asthma.⁷ Subjects sleeping in the bottom bed of a bunk may be exposed to higher levels of mites owing to the "sandwich" position between two mite infested mattresses. In the present study, 60% of subjects showed mite sensitization, but differences between top-bed and bottom-bed subjects were not found. Whereas Der p I levels over 2 micrograms (equivalent to 100 mites) per gram of house dust are a risk factor for developing mite sensitization and levels higher than 10 $\mu\text{g/g}$ are a

Table 1. Characteristics of the 94 Patients in Relation to Their Bunk Position

	Top Bed	Bottom Bed	
Sex (male/female)	21/26	22/25	NS
Age in years ($x \pm \text{SD}$)	16 $\pm$ 5	16 $\pm$ 7	NS
Age (yr) at start of bunk use ($x \pm \text{SD}$)	7 $\pm$ 5	7 $\pm$ 5	NS
Duration (yr) of bunk use ($x \pm \text{SD}$)	6 $\pm$ 5	6 $\pm$ 5	NS
Mite prick tests (positive/negative)	28/19	29/18	NS
Allergy respiratory symptoms/no symptoms	33/14	34/13	NS
Asthma/rhinitis	16/17	25/9	$P < .05$

Table 2. Respiratory Allergy Symptoms, Family Atopy Background, Smoke and Pet Exposure, Type of Mattresses and Bunks in Patients Sensitized and Non-sensitized to Mites

		Skin Tests		
		Positive	Negative	
Respiratory symptoms	No symptoms	5	22	
	Rhinitis	17	9	$P = .001$
	Asthma	35	6	$P < .001$
Family atopy background	Yes	39	15	
	No	18	22	$P = .007$
Indoor smoking	Yes	29	19	
	No	28	18	NS
House pets	Yes	24	18	
	No	33	19	NS
Mattress	Foam	23	11	
	Springs	34	26	NS
Bunk	Parallel	48	32	
	Crossed	9	5	NS

Table 3. Median (range) of Der p I, Der f I, and Der II Concentrations in 16 Paired Bedding Dust Samples from 8 Bunks

Allergen	Top Bed ($\mu\text{g/g}$ dust)	Bottom Bed ($\mu\text{g/g}$ dust)	P
Der p I	7.84 (0.27–140.59)	11.9 (0.4–562.29)	NS
Der f I	1.11 (0–28.5)	1.3 (0–54.2)	NS
Der II	5.8 (0–23.6)	8 (0.81–164.79)	NS

risk factor for asthma in the general population,^{8,9} Munir et al¹⁰ demonstrated that even lower levels of indoor allergens constitute a risk factor for sensitization in children from atopic families, thus implying different levels of risk depending on the population. The high prevalence of mite sensitization in our subjects may be due to the recruitment of subjects from those attending an outpatient allergy clinic for the first time.

In this study, a higher prevalence of asthma was found in the bottom-bed

sleeping group. Since other bias factors such as genetic predisposition, exposure to pets, and/or smoking could be ruled out, greater allergen exposure in the bottom-bed group could constitute a risk factor for developing asthma. In fact, a tendency towards higher Der p I levels was observed in the bottom-bed compared with the top-bed group (median higher than 10 $\mu\text{g/g}$), although the difference did not reach statistical significance, perhaps due to the small size of the sample studied and the wide range of values.

Furthermore, measurement of mattress mite levels at a particular moment does not reflect the dynamics of exposure during sleep, when movements of the top-bed sleeper may cause particles of top-mattress house dust to be released over the bottom-bed sleeper.

The association of positive skin tests with the presence of asthma or allergic rhinitis and family atopy background were expected and well known.¹¹ On the other hand, no association was found between indoor smoking and/or pet exposure and mite sensitization. It should be pointed out that these two variables may have changed over time and present exposure does not necessarily reflect past exposure. Whereas Wickens et al¹² found higher levels of Der p I in spring mattresses compared with foam or water mattresses, we found no differences in mite sensitization levels related to the type of mattress or bunk used.

New mattresses are easily contaminated by mites and it has been demonstrated that Der p I levels found in new mattresses after 4 months are significantly related to those of the pre-existing bedroom carpets.¹³ Mattress mite colonization from another mite source must be taken into account and anti-allergic measures taken for all items capable of harboring mites, in the case of double-bed bunks, in the two mattresses.

Results of the present study show the prevalence of asthma to be higher in individuals sleeping in the bottom bed of a double bunk and suggest that

subjects sensitized to mites or with a family atopy background should sleep in the top bed and, if possible, in separate beds.

ACKNOWLEDGMENTS

We thank Adoración Merelo and Conchita Miranda for technical assistance, and ALK Abelló (Madrid, Spain) for DEA-test determination.

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