Korean J Parasitol. Vol. 46, No. 3: 187-189, September 2008 DOI: 10.3347/kjp.2008.46.3.187

▣ BRIEF COMMUNICATION

House Dust Mite Allergens in Domestic Homes in Cheonan, Korea

Hae-Seon Nam[1], Robert Siebers[2,*], Sun-Hwa Lee[1], Joon-Soo Park[3], Yong-Bae Kim[4], Young-Jin Choi[5], Sang-Han Lee[6] and Julian Crane[2]

[1]Department of Clinical Parasitology, [3]Department of Pediatrics, [4]Department of Preventive Medicine, [5]Department of Laboratory Medicine, [6]Department of Biochemistry, School of Medicine, Soonchunhyang University, Cheonan 330-090, Korea; [2]Wellington Asthma Research Group, School of Medicine and Health Sciences, University of Otago, Wellington 6242, New Zealand

Abstract: House dust mites produce inhalant allergens of importance to allergic patients. We measured the major group 1 allergens, Der p 1 and Der f 1, from the house dust mites *Dermatophagoides pteronyssinus* and *Dermatophagoides farina*, respectively in 100 randomly selected domestic homes from Cheonan, Korea. Dust samples were collected by vacuuming from the living room floor and 1 mattress in each home. Der p 1 and Der f 1 were measured by double monoclonal ELISA. Der p 1 levels were very low, with geometric mean levels for floors and mattresses being 0.11 μg/g (range: 0.01-4.05) and 0.14 μg/g (range: 0.01-30.0), respectively. Corresponding levels of Der f 1 were higher, 7.46 μg/g (range: 0.01-262.9) and 10.2 μg/g (range: 0.01-230.9) for floors and mattresses, respectively. *D. farinae* appears to be the dominant house dust mite in Cheonan.

Key words: *Dermatophagoides pteronyssinus*, *Dermatophagoides farina*, house dust mite, allergen, asthma, Korea

Allergens from house dust mites (HDM) induce IgE mediated sensitization in susceptible individuals and cause asthma symptoms in those sensitized [1-3]. However, recent studies have suggested non-linear relationships between allergen exposure and sensitization [4,5]. Avoidance to HDM allergens appears to be beneficial [6,7], although some disagree [8]. At least 50 species of HDM that have been found in domestic house dust, and the 2 mites of the family Pyroglyphidae, namely *Dermatophagoides pteronyssinus* and *Dermatophagoides farinae*, are the most important in temperate climates, both in terms of numbers and of clinical relevance. In Korea both species are present, although geographical variations have been shown [9]. In a previous study we measured HDM allergen from pillows and mattresses in 13 Korean households and found only the major group HDM allergen Der f 1, but not Der p 1, suggesting that the HDM, *D. farinae*, is dominant in Cheonan [10]. In the present study, we report on HDM allergen levels from living room floors and mattresses in 100 homes in Cheonan, a city surrounded by small mountains northeast of South Chungcheong province with a population of around 510,000 as of 2004. The average temperature in Cheonan in January is -3℃ rising to an average of 25℃ in August with a yearly average of 11.8℃. Average yearly rainfall is 1,313 mm.

The study was performed between March and December, 2006. Dust samples were collected from living room floors and mattresses from 100 apartments that had mattresses on bedsteads by vacuuming a 1 m^2 area for 1 min with a 540 W vacuum cleaner fitted with a 25 μm pore size nylon mesh bag, as previously described [11]. The dust samples were weighed and stored at -20℃ before extraction and analysis.

Dust samples were extracted as previously described [12] with phosphate-buffered saline containing 0.05% Tween-20, pH 7.4, shaken for 30 min at room temperature and then centrifuged for 10 min at 3,000 g. A portion of the supernatant was removed and stored at -20℃ for HDM allergens analysis.

The HDM allergens, Der f 1 and Der p 1, were determined by double monoclonal antibody ELISA methodology with commercial kits (Indoor Biotechnologies, Charlottesville, Virginia, USA) as previously described [11]. Due to log-normal distribution, HDM allergen levels, expressed as micrograms per gram of dust (μg/g) and per unit area (μg/m^2), are reported as geometric means with range of values. Undetectable levels were assigned the detection limit of 0.01 μg/g or μg/m^2.

The mean dust weight collected from mattresses was 0.542 g, range: 0.003-3.199, while the mean dust weight collected from

• Received 18 June 2008, accepted after revision 28 July 2008.

* Corresponding author (rob.siebers@otago.ac.nz)

Table 1. House dust mite allergen in 100 homes as represented by geometric mean levels with range of values

Allergen	Mattresses (μg/g)	Living room floors (μg/g)	Mattresses (μg/m^2)	Living room floors (μg/m^2)
Der f 1	10.2 (0.01-230.9)	7.5 (0.01-262.9)	4.0 (0.01-112.1)	0.34 (0.01-295.4)
Der p 1	0.14 (0.01-30.0)	0.11 (0.01-4.1)	0.02 (0.01-8.8)	0.01 (0.01-0.35)

living room floors was 0.225 g, range: 0.0008-3.180. However, the amount of dust from carpeted floors (mean: 0.518 g; range: 0.0081-3.180; n = 42) was about 40-fold higher than from uncarpeted floors (mean: 0.013 g; range: 0.0008-0.063; n = 58).

Der f 1 was detected in 100% of mattresses and 93% of living room floors while Der p 1 was detected only in 12% of mattresses and in 7% of living room floors. Table 1 shows the geometric mean levels with range of values of Der p 1 and Der f 1 from mattresses and living room floors.

Der f 1 levels from carpeted living room floors (n = 42) were 15-fold higher than from uncarpeted living room floors (n = 58) when expressed per unit area (μg/m^2). Geometric mean Der f 1 levels (with range of values) were 1.67 μg/m^2 (0.1-295.4) and 0.11 μg/m^2 (0.1-0.65), respectively for carpeted and uncarpeted living room floors. Expressed as concentrations (μg/g), there were no significant differences in these levels (data not shown).

Our study showed that the major group allergen Der f 1 from the HDM *D. farinae* is the dominant allergen in the home environment in Cheonan. Although the geometric mean levels of HDM allergens in Cheonan were low compared to other countries, there were a significant number of individual high levels. Exacerbation of asthma symptoms in those sensitized to HDM can occur at levels of above 10 μg/g [13]. In our study, 58% of mattresses and 50% of living room floors had Der f 1 levels above this level. Furthermore, Der f 1 levels from carpeted floors were much higher than those from uncarpeted floors. This has also been demonstrated in New Zealand [11]. Almost every Korean home has a hot water floor heating system and therefore does not require carpeting for warmth. However, with an increased westernized life style, more Korean homes have carpets, as evidenced in our study where 42% of homes had carpets in the living room.

Der p 1 levels in homes from Cheonan were much lower than those of Der f 1 levels. Only 2 mattresses had Der p 1 levels above 10 μg/g but no floor samples were above that level. Also, Der p 1 was undetectable in the majority of samples. However, as there were some individuals with very high levels, it would be prudent to analyse allergens from both house dust mite species when assessing allergen exposure.

The geometric mean of Der f 1 from mattresses in the present study was 10.2 μg/g. This is significantly higher than the geometric mean of Der f 1 (1.18 μg/g) from a previous study in the same location [10]. However, in that study we had only sampled 13 mattresses, compared to 100 mattresses in the present study which more likely represents a truer level in Cheonan.

The prevalence of doctor-diagnosed asthma in Korean adolescents aged 12 to 15 yr in 2000 was 5.3%, a significant increase from 2.7% in 1995 [14]. In addition, 74% of Korean asthmatic children are sensitized to HDM [15]. As studies have shown that sensitization to HDM is associated with development of asthma in children [1], HDM exposure and the severity of asthma shows a dose response relation [3], and that HDM allergen avoidance can reverse asthma symptoms [6,7], the levels of HDM allergens in Cheonan could be of importance.

In conclusion, the major group 1 allergen from *D. farinae* is the dominant HDM allergen in Cheonan. Although relatively low in comparison to other countries, such as New Zealand, there were a significant number of homes with high levels that may be of importance to house dust mite sensitized patients.

ACKNOWLEDGEMENTS

This study was supported by the Academic Research Service Program of the Korean National Institute of Health, 2006.

REFERENCES

1. Illi S, von Mutius E, Lau S, Nickel R, Niggeman B, Sommerfeld C, Wahn U; Multicenter Allergy Study Group. The pattern of atopic sensitization is associated with the development of asthma in childhood. J Allergy Clin Immunol 2001; 108: 709-714.
2. Sporik R, Holgate ST, Platts-Mills TA, Cogswell JJ. Exposure to house-dust mite allergen (Der p 1) and the development of asthma in childhood. A prospective study. N Engl J Med 1990; 323: 502-507.
3. Peat JK, Tovey E, Toelle BG, Haby MM, Gray EJ, Mahmic A, Woolcock AJ. House dust mite allergens. A major risk factor for childhood asthma in Australia. Am J Respir Crit Care Med 1996; 153: 141-146.

4. Tovey ER, Almqvist C, Li Q, Crisafulli D, Marks GB. Nonlinear relationship of mite allergen exposure to mite sensitization and asthma in a birth cohort. J Allergy Clin Immunol 2008; 122: 114-118.
5. Schram-Bijkerk D, Doekes G, Boeve M, Douwes J, Riedler J, Ublagger E, von Mutius E, Budde J, Pershagen G, van Hage M, Wickman M, Braun-Fahrlander C, Waser M, Brunekreef B; PARSIFAL Study Group. Nonlinear relations between house dust mite allergen levels and mite senzitisation in farm and nonfarm children. Allergy 2006; 61: 640-647.
6. Platts-Mills TA, Tovey ER, Mitchell EB, Moszoro H, Nock P, Wilkins SR. Reduction of bronchial hyper reactivity during prolonged allergen avoidance. Lancet 1982; 2: 675-678.
7. Ehnert B, Lau-Schadendorf S, Weber A, Buettner P, Schou C, Wahn U. Reducing domestic exposure to dust mite allergen reduces bronchial hyperreactivity in sensitive children with asthma. J Allergy Clin Immunol 1992; 90: 135-138.
8. Woodcock A, Forster L, Matthews E, Martin J, Letley L, Vickers M, Britton J, Strachan D, Howarth P, Altmann D, Frost C, Custovic A; Medical Research Council General Practice Research Framework. Control of exposure to mite allergen and allergen-impermeable bed covers for adults with asthma. N Engl J Med 2003; 349: 225-236.
9. Ree HI, Jeon SH, Lee IY, Hong CS, Lee DK. Fauna and geographical distribution of house dust mites in Korea. Korean J Parasitol 1997; 35: 9-17.
10. Nam HS, Park CS, Crane J, Siebers R. Endotoxin and house dust mite allergen levels on synthetic and buckwheat pillows. J Korean Med Sci 2004; 19: 505-508.
11. Wickens K, Siebers R, Ellis I, Lewis S, Sawyer G, Tohill S, Stone L, Kent R, Kennedy J, Slater T, Crothall A, Trethowen H, Pearce N, Fitzharris P, Crane J. Determinants of house dust mite allergen in homes in Wellington, New Zealand. Clin Exp Allergy 1997; 27: 1077-1085.
12. Siebers R, Luey B, Crane J, Fitzharris P. The effects of temperature and buffer on the extraction of Der p 1 from dust. J Allergy Clin Immunol 1997; 100: 580.
13. Platts-Mills TA, 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: 1046-1060.
14. Hong SJ, Lee MS, Sohn MH, Shim JY, Han YS, Park KS, Ahn YM, Son BK, Lee HB; Korean ISAAC Study Group. Self-reported prevalence and risk factors of asthma among Korean adolescents: 5-year follow-up study, 1995-2000. Clin Exp Allergy 2004; 34: 1556-1562.
15. Yoo Y, Yu J, Kang H, Kim DK, Koh YY, Kim CK. Birth month and sensitization to house dust mites in asthmatic children. Allergy 2005; 60: 1327-1330.