



An Investigation of Aeroallergens Affecting Urban Malaysian Asthmatics

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Inhaled allergens can sensitize susceptible individuals resulting in airway hyperresponsiveness manifesting as bronchial asthma. There are several reports of allergens affecting Malaysian patients with allergic rhinitis,^{1,2,3} but data on allergens affecting Malaysian asthmatics is scarce. We are only aware of a relevant article by Leung and Ho⁴ which included Kota Kinabalu in East Malaysia as one of the South-East Asian cities studied. We report here a study on the immediate response of 200 Malaysian asthmatic patients by using skin prick test (SPT) with a panel of 14 aeroallergens, and we relate the SPT response to the patients' answers to a questionnaire on factors related to their asthma.

Skin prick test (SPT) is the most common way, besides history and clinical examination, of determining hypersensitivity to specific inhaled allergens. Although operator-dependent, SPT can be standardized and the data used for the evaluation of hypersensitivity to

SUMMARY We investigated the aeroallergens affecting 200 asthmatics from the University Hospital in Kuala Lumpur, Malaysia and found 164 (82%) patients with skin prick test (SPT) reactivity to one or more of a panel of 14 allergens, which included indoor and outdoor animal and plant aeroallergens. Reactivity was most frequent to the indoor airborne allergens, with 159 (79.5%) reacting to either or both house dust mite (*Dermatophagoides*) species and 87 (43.5%) to cockroach. The SPT reactivity to house dust mites corresponded with the finding that patients found house dust to be the main precipitant of asthmatic attacks.

specific allergens, and the development of control strategies for minimizing asthmatic attacks.

MATERIALS AND METHODS

Subjects

Subjects were patients with clinical symptoms and a history of asthma identified by a consultant chest physician from those attending the Chest Clinic of the University Hospital in Kuala Lumpur. Over a period of 18 months (from January 1996 to July 1997) there were 200 patients of various races (79 Malays, 55 Chinese; 62 Indians and 4 of other races) who consented to SPT. The ratio of female

to male patients was 2.3:1, with ages ranging from 12 to 77 years with 128 (64%) being over 40 years of age (mean age = 45.2 ± 12.5 years). Informed consent was obtained from the patients before the SPT. Patients were told to abstain from taking any antihistamine for at least a week prior to the SPT so as to avoid false negative results. Patients were interviewed by either of two researchers using a simple questionnaire about the presence of other allergic manifestations, family

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history, accommodation and self-observed precipitants of asthma exacerbation.

Allergens

The panel of 14 allergens was selected based upon local presence and perceived clinical importance according to previous related studies. Indoor allergens included the house dust mite (HDM) *Dermatophagoides* spp. *pteronyssinus* and *farinae*, house dust extract and cockroach (*Periplaneta americana*). Animal allergens were cat hair and dog hair. Dog hair was tested only on non-Muslims. Three types of grass pollen (Bermuda, Bahia, rough pigweed) and an extract of mixed grass leaves (Bermuda, Johnson, Kentucky Blue, Timothy, Red-top, Orchard and Sweet Vernal) were tested. Two other pollens came from flowering plants of *Acacia* spp. and *Melaleuca leucadendron*. The fungus *Aspergillus fumigatus* and a mold mix (*Alternaria*, *Aspergillus* mix, *Fusarium*, *Helminthosporium*, *Cladosporium*, *Mucor*, *Penicillin* mix, *Phoma*, *Pullularia* and *Rhizopus*) were also tested. The allergen extracts, prepared in 50% glycerol (10,000 AU/ml) and ready to be used in SPT, were purchased from Meridian (Texas, USA), and were kept at 4°C and aliquoted in small amounts for each SPT session.

Controls

Thirteen healthy subjects served as controls, all affirming that they did not suffer from any allergies nor were they affected by aeroallergens such as dust. These controls were subjected to the same SPT and answered the same questionnaire.

Skin prick test (SPT)

This percutaneous test was performed and read by two researchers who constantly referred to each other to ensure uniformity in their SPT. SPT was performed routinely between 2-5 p.m., to avoid circadian variation. A volume of 6 µl of each extract was dropped on the skin, 2 cm apart, on the volar surface of the patient's forearm. Histamine (Sigma Chemicals) at 1 mg/ml and PBS (1 M, pH 7.2), both diluted in 50% glycerol, served as the positive and negative controls, respectively. A sterile syringe needle (STERICAN, West Germany) was then used to prick the skin through the extract, allowing penetration of extract into the skin. Residues of extract were blotted away and results were read after 15 minutes. The diameters of the wheals were measured. A diameter of half or more than the size of histamine wheal was taken as a positive result, as in Backman, 1994.⁵

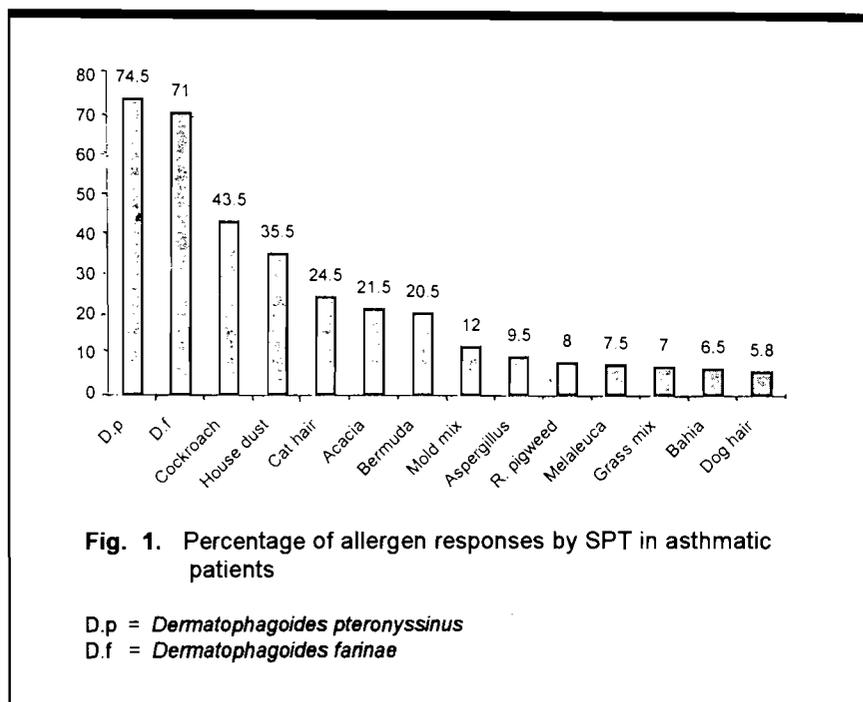
RESULTS

One hundred and sixty four (82.0%) of the 200 patients tested

positive in SPT while all 13 controls did not react to any of the allergens. Only 11 patients (5.5%) reacted to one allergen in the panel while the rest reacted to more than one allergen (Table 1). Among the patients who reacted to only one allergen, 4 reacted to *D. pteronyssinus* and 1 to the other HDM species, *D. farinae*. Four patients reacted only to the cockroach allergen, one to cat hair and another to the mold, *Aspergillus fumigatus*. Thirty five patients (17.5%) reacted to two allergens, and 27 (77.1%) of them were to the two HDM species. Eighty six patients (43.0%) reacted to more than two but less than six allergens in the panel. The rest of the patients (16%) showed reactions to more than five allergens. The five major aeroallergens affecting asthmatics were the house dust mites *D. pteronyssinus* and *D. farinae*, followed by cockroach, house dust extract and cat hair (Fig. 1). One hundred and forty nine patients (74.5%) reacted to *D. pteronyssinus* and 142 (71.0%) to *D. farinae*. Taken together, 159 patients (79.5%) reacted to either or both of the mites. The cockroach *Periplaneta americana* was next, with reaction from 87 (43.5%) pa-

Table 1. Percentage of response to number of allergens in asthmatic patients

No. of SPT response to allergens	No. of patients	%
0	36	18
1	11	5.5
2	35	17.5
3 - 5	86	43.0
> 5	32	16.0



tients. The house dust extract elicited response in 71 (35.5%) patients. The next significant aeroallergen was cat hair, detected in nearly a quarter of the asthmatic patients (49 patients). Allergens of plant origin, namely, pollen of *Acacia* (43 patients, 21.5%) and Bermuda grass (41 patients, 20.5%), elicited reaction from about a fifth of the asthma patients. However, other plant allergens induced less reaction from the patients; rough pigweed pollen (16 patients, 8.0%), *Melaleuca* pollen (15 patients, 7.5%), Bahia grass pollen (13 patients, 6.5%) and mixed grass leaves (14 patients, 7.0%). Taken together, 46 (23%) of the patients reacted to one or more of the grass pollens, and 60 (30%) to one or more of any of the pollens. No patient was found to be allergic to pollen alone. Twenty four patients (12%) reacted to the mold mix while 19 (9.5%) were positive to *Aspergillus*. Amongst the 19, 7 were also positive to the mold mix.

Only non-Muslim patients were tested with dog hair allergen extract, to which only 7 (5.8% of 121 patients) showed a positive reaction.

Questionnaire

Self-reported allergy status

Ten percent of the asthmatic patients and all the control subjects said they did not suffer from any allergy-related symptoms while 71.0% of the patients suffer from allergic rhinitis, 50.0% allergen-induced headache, 42.5% itchy eyes, 22.0% urticaria and 24.5% eczema. Only 61.0% of the asthma patients and 30.8% of the control subjects had a family history of allergy.

Accommodation Description

Patients in this study were largely from the middle income group, living in suburban concrete or wooden houses. Fifty one per-

cent of the patients' homes had carpets, a customary indoor decorative item in the living room of many Malaysian homes. Twenty-four percent of the patients had pets, with cats being the most common. Seventy-nine percent of the patients were aware of pests such as cockroaches or rats in their homes. On staying away from home, 16% felt their asthmatic symptoms became better while 6% felt worse. However, 69% said their asthma showed no change, while the rest (9%) were not aware of any difference.

Asthma precipitants

A significant proportion of patients (79.5%) claimed that their asthma attacks were precipitated by exposure to house dust. Animal dander exposure was held responsible for precipitating asthma attacks by 8% of the patients, while none attributed any attack to plant aeroallergen, although two persons recalled suffering pollen-induced asthmatic attacks while stationed in temperate countries.

DISCUSSION

Results of our questionnaire demonstrated that ninety percent of asthmatics suffer from some manifestations of allergy, and 80% were to house-dust. This corresponded with the finding of the SPT in which indoor aeroallergens such as the house dust mites, the house dust and cockroach are the predominant aeroallergens, with skin-prick reactivity in over 80% of the asthmatics. As with other previous studies conducted in Malaysia¹ and in the Far East,⁶ allergens from the HDM rank highest among allergens affecting atopic patients. Interestingly the cockroach, which was not

thought of as a major allergen until recently, emerged as an important allergen in this study. The predominant cockroach species in Malaysia, *P. americana*, commonly found in the kitchen as well as in storage spaces, was used in this study. The cockroach contributes allergens in the form of fecal particles and saliva.⁷

House dust does not contain a uniform pool of degenerated and discarded proteins. Contents of this composite substance differ from house to house, number of occupants, frequency of house-keeping, indoor pets, etc. In our study the percentage of patients reacting to house dust extract was found to be less than that reacting to extracts of house dust mites and cockroaches. This would be due to the lower concentration or the absence of certain relevant allergens in the house dust preparation. For example, Witteman *et al.*⁸ found silverfish antigens in most house dust samples which indicated that other arthropods besides mites and cockroach are also included in the house dust.

Cat hair is a more significant allergen than dog hair. Among 39 patients who keep dogs but no cat in their household, 3 had SPT response to dog hair but 10 to cat hair. This is probably because dog hair is heavier and less likely to be airborne while cat hair easily contaminates the environment, and together with cat's saliva, are known to trigger allergy-related asthmatic attacks.^{9,10} Additionally, in Malay-

sian homes, dogs are usually kept outdoors. Only 11 of the patients kept cats at home, although cats are popular pets in Malaysia.

Contrary to the definite role of pollen in causing hayfever during flowering months in temperate countries, none of the asthmatics in our study held plant-derived aeroallergens to be responsible for precipitating their asthmatic attacks, although 30% of the asthmatics reacted positively in SPT to pollen from grasses or *Acacia* and *Melaleuca*. *Acacia* and *Melaleuca* plants are commonly found in the vicinity of the University Hospital, but grass pollen used for SPT were from genera different from local grasses, though all grasses belong to the family Gramineae and may have similar pollen. Data from the questionnaire and the finding that 30% had SPT reactivity to pollen, but none to pollen alone, suggest that pollen are not major allergens, especially since there is no distinct flowering season in Malaysia and patients were always having to contend with other major aeroallergens.

Molds were not a major allergen affecting the asthmatics. It is probable that the subjects in this study were middle class urban dwellers living in well-ventilated concrete houses which are not prone to having large amounts of fungal growth indoors.

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REFERENCES

1. Thomas V, Tan BH, Rajapaksa ACP. *Dermatophagoides pteronyssinus* and house dust allergy in West Malaysia. *Ann Allergy* 1978; 40: 114-6.
2. Ho TM, Murad S, Kesavapillai R, Singaram SP. Prevalence of allergy to some inhalants among rhinitis patients in Malaysia. *Asian Pac J Allergy Immunol* 1995; 13: 11-6.
3. Sam CK, Lee STS. Specific IgE in the identification of allergens in allergic rhinitis Malaysian patients. *Asian Pac J Allergy Immunol* 1995; 13: 23-7.
4. Leung R, Ho P. Asthma, allergy and atopy in three south-east Asian populations. *Thorax* 1994; 49: 1205-10.
5. Backman A. Skin test for epidemiologic studies. *Allergy* 1994; 49: 493-4.
6. Lai CKW, Douglass C, Ho SS, Chan J, Lau J, Wong G, Leung R. Asthma epidemiology in the Far East. *Clin Exp Allergy* 1996; 26: 5-12.
7. Kang B, Vellody D, Homburger H, Yunginger JW. Cockroach cause of allergic asthma: its specificity and immunologic profile. *J Allergy Clin Immunol* 1979; 63: 80-6.
8. Witteman AM, Voorneman R, Van den Oudenrijn S, van Leeuwen J, Akkerdaas J, Van der Zee JS, Aalberse RC. Silverfish protein in house in relation to mite and total arthropod level. *Clin Exp Allergy* 1996; 26: 1171-6.
9. King HC. *An Otolaryngologist's Guide to Allergy*. Thieme Medical Publishers, Inc. NY 1990; 53-69.
10. Platts-Mills TAE, Chapman MD, Pollart SM, Heymann PW, Luczynska CM. Establishing health standards for indoor foreign proteins related to asthma: Dust mite, cat and cockroach. In: Ozkaynak H, Spengler J, editors. *Indoor air quality risk assessment*. Princeton Scientific Pub. 1990; 197-208.