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Original article

Laboratory assessment of the efficiency of encasing materials against house dust mites and their allergens

Background: The current recommendation to reduce mite allergen exposure for mite-sensitive individuals is to use allergen-impermeable bed coverings. As these covers are made of various kinds of materials, they vary in quality. The objective of this study was to investigate the efficiency of different covering materials against house dust mites and their allergens *in vitro*.
Methods: Four types of materials including (1) plastic cover, (2) polyurethane-coated cover, (3) non-woven covers, (4) tightly woven microfiber covers and a regular cotton bed sheet (as a control) were evaluated using three methods: (i) heat escape method, (ii) Siriraj chamber method and stereomicroscopy, scanning electron microscopy and (iii) enzyme-linked immunosorbent assay (ELISA).
Results: We found that there was a statistically significant difference in allergen permeability among four types of coverings ($P < 0.001$). In terms of the impermeability to mites and their allergens, plastic- and polyurethane-coated covers were observed to be the best, followed by non-woven, woven and cotton-based bed sheets. A regular cotton-based bed sheet allows a significant amount of leakage of mite allergens. Both woven and non-woven material are efficient barriers against mite allergen in terms of impermeability. However, with regard to mite colonization, non-woven covers have the drawback of mites being able to penetrate and colonize within the fabric fibers. Woven covers are therefore recommended because of their major advantages of not allowing the colonization of mites within the fabric, being easy to clean, and comfortable.
Conclusion: The three assessment methods used in this study could be useful as a primary approach to evaluate the quality of covering materials *in vitro* using both pore size and ability to be colonized by mites on the materials as the key factors.

V. Mahakittikun[1], C. Komoltri[2], H. Nochot[1], A. C. Angus[3], F. T. Chew[3]
[1]Department of Parasitology, [2]Clinical Epidemiology Unit, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok, Thailand; [3]Department of Paediatrics and Biological Sciences, National University of Singapore, Singapore

Key words: encasing; house dust mite; impermeable covers; mattress covers.

Vanna Mahakittikun
Department of Parasitology
Faculty of Medicine Siriraj Hospital
Mahidol University
Bangkok 10700
Thailand

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Exposure to house dust mite (HDM) is an established risk factor for exacerbation of asthma. It has been demonstrated that high level of exposure to HDM is associated with more severe asthma (1, 2). Mites are found in many different sites in houses with the bedroom being the most prominent site (3, 4). Mattresses and pillows are the major habitats for dust mites (5). Several strategies have been used in an attempt to control house dust mite, including killing mites by physical or chemical methods. However, the most practical method recommended is to encase the bedding with an allergen-impermeable cover (6), which is considered the first approach in allergen avoidance (7). For example, in the Netherlands, the use of anti-allergic encasing has become a standard procedure in the treatment of HDM-allergic asthmatic patients (8). The main purpose of encasement is to block the leakage of dust mites and their fecal pellets from the bedding. Most of the previous studies of allergen avoidance using impermeable covers have emphasized the clinical benefit in asthmatic patients and demonstrated a reduction in mite allergen concentration after encasing the mattresses for a period of time (9–12). Although there are several encasing materials commercially available, the issue of quality in terms of house dust mite protection is often overlooked. Methods to evaluate impermeability are seldom mentioned. Vaughan et al. (13) studied the permeability of woven and non-woven fabrics by measuring the pressure gradient across the fabric. The results indicated that both types of fabrics can be permeable to air and still provide efficient barriers to cat and dust mite allergens. It was recommended that fabrics with a pore size of 2–10 μm are suitable for use as encasing materials because of their ability to block the passage of all dust mite allergens (13). The objective of this study was to investigate the efficiency of different cover materials against house dust mites and their allergens *in vitro*.