allergic urticaria, or eczema in the previous year. The prevalence of outcomes between the probiotic and placebo groups was compared.

RESULTS. There were no differences in any of the allergic disease outcomes between the probiotic and placebo groups. Both groups had a similar prevalence of allergic disease generally and asthma, allergic rhinoconjunctivitis, and eczema specifically. The prevalence of allergic sensitization, according to results of both skin prick testing and IgE testing, was also similar between the 2 groups, as were lung function and fractional exhaled nitric oxide levels. Post-hoc analyses to determine if any subpopulation exhibited evidence of benefit found that neither maternal allergic history nor delivery mode was associated with a beneficial effect of probiotic supplementation. Because adherence was high (>95%) in the parent RCT, these findings were not attributable to poor adherence. Probiotic supplementation was also not associated with adverse effects at school age, including effects on growth and gastrointestinal symptoms.

CONCLUSIONS. Supplementation with _L reuteri_ perinatally and in infancy transiently reduced the risk of allergic sensitization, but it had no effect on allergic disease outcomes or allergic sensitization at school age.

REVIEWER COMMENTS. This long-term follow-up of one of the only “successful” probiotic trials for prevention of allergic disease indicates that any effect of probiotics is, at best, transient. However, recent studies point to a role of the gut microbiome in immune development; it is therefore possible that other approaches to modifying the gut microbiome may prove effective in the prevention of allergic disease.

Supplementation With Probiotics in the First 6 Months of Life Did Not Protect Against Eczema and Allergy in At-Risk Asian Infants: A 5-Year Follow-up


PURPOSE OF THE STUDY. The authors had previously reported that supplementing infants at risk for allergic disease with probiotics did not prevent eczema or allergen sensitization in the first year of life. The present study evaluated the allergic outcomes of these same subjects at 5 years of age.

STUDY POPULATION. In this Singaporean study, qualifying term infants had a first-degree relative who not only had a diagnosis of asthma, allergic rhinitis, or eczema but also a positive result on skin prick testing to _Dermatophagoides pteronyssinus_ and/or _Blomia tropicalis_. A total of 124 infants were given cow’s milk formula with probiotics and 121 infants were given cow’s milk formula without probiotics from the first day of life until 6 months of age. By 5 years, 87% had completed the study (112 who were on probiotics and 108 who did not receive probiotics).

METHODS. Subjects received at least 60 mL (9.26 g) per day of commercially available cow’s milk-based infant formula in this double-blind, placebo-controlled randomized study. Probiotic supplementation was with _Bifidobacterium longum_ (BL999) and _Lactobacillus rhamnosus_ (LPR). During regular follow-up visits over the next 5 years, children were assessed for asthma, allergic rhinitis, eczema, and food allergy.

RESULTS. At the age of 5 years, presence of eczema and eczema severity according to the SCORAD (Scoring Atopic Dermatitis) index were not significantly different between the probiotic group and the placebo group (16.9 vs 15.3; _P_ = .295). There was also no significant difference between the 2 groups for asthma development, food allergy, and dust mite sensitization. Of note, those subjects who consumed probiotics on their own accord after the initial 6-month treatment period were statistically associated with a reduced incidence of asthma and allergic rhinitis at 5 years of age. There was no difference in growth rate (for height and weight) between the 2 study populations.

CONCLUSIONS. Early-life supplementation with probiotics did not change allergic outcomes at 5 years of age.

REVIEWER COMMENTS. Studies in Scandinavia, Australia, and Germany have had similar negative findings. Nevertheless, the authors noted that those infants who continued probiotic supplementation once a week from the age of 2 years for at least 1 year did have a reduced incidence of asthma and allergic rhinitis, no matter which study group they were part of. It seems we are not yet able to reach any final conclusions regarding probiotic supplementation and its influence on atopy.

Mouse Allergen Is the Major Allergen of Public Health Relevance in Baltimore City


PURPOSE OF THE STUDY. The goal of this study was to evaluate relationships between exposure to mouse and other perennial allergens and clinical markers of asthma.

STUDY POPULATION. A total of 150 Baltimore children (ages 5–17 years) with persistent asthma were followed up for 1 year.

METHODS. Allergy skin testing was performed to dust mites, mouse, cockroach, cat, dog, and other perennial allergens.
Serum-specific IgE levels to those allergens were also measured. Sensitization was defined as a skin test wheal $\geq 3$ mm in diameter more than the negative control subjects. Spirometry with bronchodilator reversibility ($\geq 12\%$ reversibility in forced expiratory volume in 1 second [FEV$_1$] after 2 puffs of albuterol) and fraction of exhaled nitric oxide (FENO) was performed at baseline and every 3 months thereafter. Health care use, asthma symptoms, and medication use were assessed by using a questionnaire. Levels of major allergens from mouse (Mus m 1), cockroach (Bl a g 1), dust mite (Der f 1), cat (Fel d 1), and dog (Can f 1) were measured in dust samples collected from beds and bedroom floors. Exposure was defined as an allergen level greater than thresholds previously determined to be clinically relevant.

RESULTS. The population was predominantly African American, low income, and poorly educated. The most common sensitizations were to cat (64%), cockroach (60%), dust mite (56%), and mouse (51%). The population was divided into those sensitized and exposed to each allergen or not sensitized and not exposed. Twenty-six percent were sensitized and exposed to mouse, 17% to cockroach, 14% to cat, and 9% to dust mite. When sensitization and bed dust exposure were compared with asthma health outcomes, mouse emerged as the most relevant allergen. Statistically significant relationships were identified for acute care visits, FEV$_1$/forced vital capacity (FVC) ratio, and bronchodilator reversibility. No other allergens were associated with such relationships. When bedroom dust was analyzed, mouse exposure was significantly associated with acute care visits, FEV$_1$/FVC ratio, FENO, and bronchodilator reversibility. Cockroach exposure was also significantly related to need for acute care visits. Elevated serum-specific IgE level to mouse but not to cockroach or other allergens was also associated with acute care for asthma visits, FEV$_1$/FVC ratio, FENO, and bronchodilator reversibility. The clinical relationships identified for mouse sensitization/exposure were independent of concurrent sensitization or exposure to other allergens.

CONCLUSIONS. In a community with high levels of mouse and cockroach allergens, mouse allergen sensitization and exposure are more strongly associated with poor asthma outcomes than cockroach sensitization and exposure.

REVIEWER COMMENTS. Previous inner-city asthma research has focused on cockroach exposure. The present study highlights the important role of another common inner-city pest, the mouse. The implications of this study are not isolated to Baltimore schoolchildren. Mouse has also emerged as a prominent allergen in Boston, and there is no reason to think the same would not be true in other cities. One tricky question is: “What do we do about it?” Decreasing exposure to perennial allergens can be difficult and/or expensive. I look forward to prospective intervention studies to help answer that question. Whatever the solution, I suspect its implementation will require the cooperation of landlords, tenants, and government officials.


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**Cat, Dog and House Dust Mite Allergen Levels on Children’s Soft Toys**


**PURPOSE OF THE STUDY.** Children’s soft toys are known to harbor house dust mite (HDM) allergens, but little is known about whether they harbor cat or dog allergens. The objective of the study was to measure cat (Fel d 1), dog (Can f 1), and HDM allergens on children’s soft toys.

**STUDY POPULATION.** Children’s soft toys and mattresses were analyzed.

**METHODS.** Dust was collected from 40 children’s soft toys and their mattresses, and data were gathered on pet ownership. Dust samples were analyzed for Fel d 1, Can f 1, Der p 1, and Der f 1 by using enzyme-linked immunosorbent assay. Results are expressed as median levels with interquartile ranges (IQRs).

**RESULTS.** Thirty-five (87.5%) soft toys had detectable Fel d 1 levels (median: 0.73 µg/g; IQR: 0.26–2.56), whereas 34 (85%) had detectable Can f 1 levels (median: 1.20 µg/g; IQR: 0.53–2.68). Correspondingly, 32 (80%) mattresses had detectable Fel d 1 levels (median: 0.18 µg/g; IQR: 0.07–1.01), whereas 34 (85%) had detectable Can f 1 levels (median: 0.50 µg/g; IQR: 0.33–1.06). All mattresses and soft toys had detectable HDM allergen (Der p 1 + Der f 1) levels, with soft toys containing $\sim$3 times higher levels than mattresses. In homes with cats ($n = 10$), Fel d 1 levels were higher on soft toys than homes without cats (2.49 vs 0.48 µg/g; $P = .0009$). In homes with dogs ($n = 25$), Can f 1 levels were generally higher on soft toys (1.38 vs 0.63 µg/g; $P = .10$).

**CONCLUSIONS.** This study has found that soft toys can harbor cat and dog allergen as well as HDM allergens, some with very high levels. Cat and dog ownership resulted in higher Fel d 1 and Can f 1 levels on soft toys and mattresses. The levels of Fel d 1, Can f 1, and HDM allergens on soft toys could be of importance to sensitized asthmatic children.

**REVIEWER COMMENTS.** Many studies have evaluated the role of the home environment such as carpet, bedding, and pets as reservoirs of allergen. Very few focus on issues specific to young children in their greatest sensitization phase. This study reminds the clinician that even benign ubiquitous children’s toys carry significant amounts of allergen that could influence asthma control in sensitized children. For families receiving asthma education, discussion of soft toys should be part of a complete environmental evaluation. Whether families choose to comply with recommendations poses its own issues.
Mouse Allergen Is the Major Allergen of Public Health Relevance in Baltimore City

Mitchell R. Lester

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