

Cockroach debris in purchased flour

R. Codina*, C. Jaén, R.F. Lockey

Key words: Bla g 2 allergen; cockroaches; contamination; flour.

• IN SOME situations, organ-based classification of allergic diseases is not appropriate (1). Mites and insects cause inhalant IgE-mediated asthma and/or rhinoconjunctivitis. However allergic symptoms, including anaphylaxis, have been reported after ingestion of insects (2) and baked goods made from flour contaminated with mites (3).

Different allergens including storage mites (4), flour beetles and moths cause occupational asthma in bakers (5) and workers exposed to grains (6,7). This study reports the presence of Bla g 2 allergen, derived from German cockroach, in flour samples.

We obtained 120 different flour packages from 19 brands, including four popular brands, from four Tampa supermarkets. These packages were wheat 48/120 (39%), wheat-processed mixes 27/120 (23%), cornmeal 38/120 (32%), and others 7/120 (6%).

Samples from all packages were heated at 350°F for 30 min. Fresh and heated samples were extracted, and Bla g 2 allergen levels of fresh and heated and Der p 1 and Der f 1 of fresh samples measured by ELISA. Mite counts were performed in all fresh samples. The following comparisons (Wilcoxon test) of Bla g 2 levels were performed: 1) fresh vs heated; 2) among supermarkets; 3) among types of flour; and 4) among the four most popular brands.

Bla g 2 was present in all (100%) fresh and 90/120 (75%) heated samples, and its values were 1.272 ± 0.776 and

0.886 ± 0.990 ($P < 0.0001$), respectively. Twenty-three of 120 (19.2%) fresh and 7/120 (5.8%) heated samples have Bla g 2 levels ≥ 2 U/g (considered the sensitization threshold).

There were no significant differences among Bla g 2 levels found in flour from the four different supermarkets but there were differences among brands (Fig. 1), which suggests that cockroach contamination most likely does not occur at the supermarket but at the factory or mill. Bla g 2 levels in wheat, wheat mixes, and cornmeal are 1.784 ± 0.382 , 2.067 ± 0.302 , and 0.485 ± 0.054 U Bla g 2/g, respectively, $P < 0.001$ wheat and wheat mixes vs cornmeal. Mites were absent in all samples and Der p 1 and Der f 1 levels below the detection level of the techniques, which supports the observation that mite contamination most likely occurs at home after the package is opened (3).

Cockroach allergens can potentially sensitize and cause IgE-mediated asthma and/or rhinoconjunctivitis in individuals exposed to flour inhalation, such as bakers and millers, especially those with an atopic background, who become sensitized by extremely low doses of allergen (1).

With mites, IgE-mediated anaphylaxis has been associated with the ingestion of large amounts of allergen (more than 5000 mites/g of food). However, milder reactions may occur when lower amounts of allergen are ingested (3). Whether Bla g 2 ingestion can cause sensitization

and IgE-mediated allergic manifestations is not known, but it should be suspected when the role of other etiologic agents is ruled out. In conclusion, cockroach allergens could be an allergen involved in occupational asthma and cause sensitization and allergic symptoms after ingestion of baked goods.

*Division of Allergy and Immunology
Department of Medicine
University of South Florida and
James A. Haley V.A. Hospital
13000 Bruce B. Downs Blvd. (MDC 19)
Tampa
FL-33612 4745
USA
Tel: +813 972 7631
Fax: +813 910 4041
E-mail: rcodina@hsc.med.usf.edu

Accepted for publication 11 December 2001
Allergy 2002; 57:260-261

Copyright © Blackwell Munksgaard 2002
ISSN 0105-4538

References

1. JOHANSSON SGO, HOURIHANE J, BOUSQUET J, et al. Position paper. A revised nomenclature for allergy. An EAACI position statement from the EAACI nomenclature task force. *Allergy* 2001;56:813-824.
2. FREYE HB, ESCH RE, LITWIN CM, SORKIN L. Anaphylaxis to the ingestion and inhalation of *Tenebrio molitor* (mealworm) or *Zophobas morio* (superworm). *Allergy Asthma Proc* 1996;17:215-219.

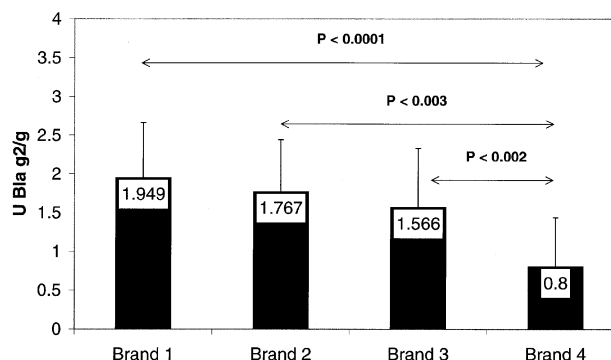


Figure 1. Bla g 2 determination in flour samples from the four commonest brands.

3. SANCHEZ-BORGES M, CAPRILES-HULETT A, SUAREZ-CHACON R, FERNANDEZ-CALDAS E. Oral anaphylaxis from mite ingestion. *ACI Int* 2001;**13**:33–35.
4. ALVAREZ MJ, TABAR AI, QUIRCE S, et al. Diversity of allergens causing occupational asthma among cereal workers as demonstrated by exposure procedures. *Clin Exp Allergy* 1996;**26**:147–153.
5. SCHULTZE-WERNINGHAUS G, ZACHGO W, ROTERMUND H, et al. *Tribolium confusum* (confused flour beetle, rice flour beetle) - an occupational allergen in bakers: demonstration of IgE antibodies. *Int Arch Allergy Appl Immunol* 1991;**94**:371–372.
6. SCHROECKENSTEIN DC, MEIER-DAVIS S, GRAZIANO FM, FALOMO A, BUSH RK. Occupational sensitivity to *Alphitobius diaperinus* (Panzer) (lesser mealworm). *J Allergy Clin Immunol* 1988;**82**:1081–1088.
7. SCHROECKENSTEIN DC, MEIER-DAVIS S, BUSH RK. Occupational sensitivity to *Tenebrio molitor*. *J Allergy Clin Immunol* 1990;**86**:182–188.

Food allergy to spinach and mushroom

I. Herrera*, I. Moneo, M.L. Caballero, S. de Paz, A. Perez Pimiento, S. Rebollo

Key words: cross-reactivity; mold hypersensitivity; mushroom; spinach.

● A 31-YEAR-OLD woman was referred for two systemic reactions after spinach intake; the second was anaphylactic shock with respiratory failure. She also had had four episodes of Oral Allergy Syndrome a few minutes after mushroom intake. For the previous eight years she had suffered from persistent allergic asthma.

Skin prick tests (SPT) were positive to mites and airborne molds, and were negative to pollens, latex and commercial spinach extract. Prick-by-prick tests with raw and boiled spinach, raw beet and chard were positive. Specific bronchial challenge with *Alternaria alternata* was positive.

Total serum IgE was 786 kU/l and specific IgE was detected to *Aspergillus fumigatus*, *Cladosporium herbarum*, *A. alternata*, *Acarus siro*, *Glycyphagus domesticus*, and cat dander.

Extracts of spinach (raw and boiled leaves, and boiling water), mushroom, chard and beet were obtained by grinding 10 g of each in 100 ml PBS. After centrifugation, supernatants were precipitated in 90% ethanol for 30 min and centrifuged for 15 min at 4500 g. Precipitates were re-dissolved in 1 ml PBS and re-centrifuged under the same conditions.

SDS-PAGE and immunoblotting of the different extracts showed the strongest recognition of spinach allergens in the 10×concentrated boiling water. Therefore, the entire *in vitro* study was performed using this spinach extract.

The spinach extract showed two main bands of 20 and 25 kDa, and several minor bands (14–18 kDa). Several bands between 14 and 35 kDa were detected in mushroom and chard extracts

Immunoblotting (1) of the spinach extract showed four bands from about 18–35 kDa. In the mushroom extract, the patient's serum recognized a 22 kDa band, a broad zone without defined bands of lower molecular weight (16–18 kDa), and a faint band of about 15 kDa. In the chard extract we detected four very faint bands from about 23–30 kDa.

Spinach immunoblotting inhibition is shown in Fig. 1A. Mushroom and chard extracts were able to inhibit recognition of spinach allergens, with complete inhibition

of three allergens between 23 and 35 kDa. Regarding mushroom immunoblotting inhibition (Fig. 1B), *C. herbarum*, spinach and chard extracts were able to cause complete inhibition of the faint 15 kDa band, which was also partially inhibited using *A. alternata* as inhibitor. The 16–18 kDa zone was partially inhibited by *C. herbarum* and spinach, and totally inhibited by chard. The upper 22 kDa band was inhibited in part by spinach and chard.

IgE-mediated allergy to vegetables has been associated with sensitization to pollens and latex by the existence of common allergens, the pathogenesis-related proteins (2). Allergic reactions after eating spinach relatively unknown, with only four cases described so far (3–6); in three of these studies, the allergy was related to latex sensitization. In our case, both *in vivo* and *in vitro* aspects of the study discarded association with sensitization to latex or pollens, including *Chenopodium album*. Furthermore, we have not found previous reports of food allergy to mushroom *Agaricus bisporus* or of cross-reactivity between edible mushrooms and airborne molds belonging to the fungi *Imperfecti*.

In conclusion, spinach and mushroom, two foods with no taxonomical relationship, must have some common epitopes responsible for this newly found cross-reactivity. Although this is a single case report, due to the fact that mold sensitization is relatively common, more in-depth study of the possible cross-

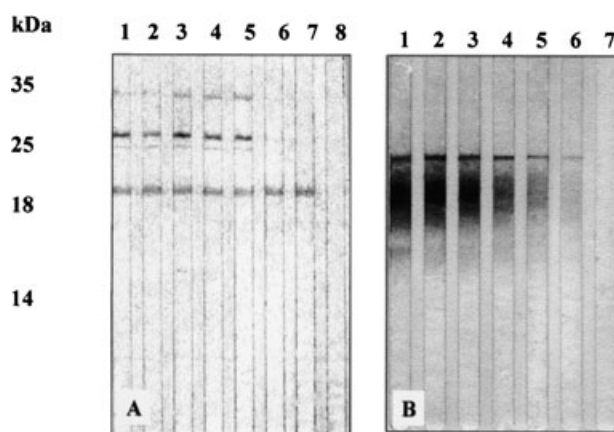


Figure 1. A: Immunoblot inhibition to spinach proteins with beet (lane 1), latex (lane 2), *Cladosporium herbarum* (lane 3), *Alternaria alternata* (lane 4), *Aspergillus fumigatus* (lane 5), chard (lane 6), mushroom (lane 7) and spinach (positive control, lane 8). B: Immunoblot inhibition to mushroom proteins with dog dander [negative control, lane 1], *Aspergillus fumigatus* (lane 2), *Alternaria alternata* (lane 3), *Cladosporium herbarum* (lane 4), spinach (lane 5), chard (lane 6), and mushroom (positive control, lane 7).