

Common allergens in avian meats

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Background: Reports of allergy to bird meats are uncommon, and most have been in patients with "bird-egg syndrome."

Objective: We sought to evaluate 3 patients who reported allergic reactions to several avian meats, but who denied allergic reactions to eating eggs. The patients required yellow fever vaccine for entry into the military.

Methods: Patients were skin tested with commercial extracts of chicken, turkey, and egg, as well as with crude extracts made from dove and quail meat, and with yellow fever vaccine. Immunoblots for IgE antibody were performed by using the same materials used for skin testing plus extracts of duck and goose meat.

Results: Skin tests were positive in all 3 patients to chicken, turkey, dove, quail, and yellow fever vaccine and negative to egg. This included some positive skin test responses to bird meats the patients denied ever having eaten. The vaccine was administered in graded doses. Immunoblots revealed IgE binding to several proteins of similar molecular weights in all of the avian meats but not to egg or yellow fever vaccine. Again, this included IgE antibody to some bird meats the patients denied ever having eaten.

Conclusion: Patients allergic to one bird meat may be allergic to others, including game birds, probably because of cross-reacting allergens. Such patients may have to exercise caution even when eating bird meats they have not previously ingested. The relationship of this allergy to yellow fever vaccine, if any, remains to be determined. (*J Allergy Clin Immunol* 1999;104:202-4).

Key words: Allergy, chicken, turkey, game birds, cross-reactivity

Allergy to chicken meat is quite rare.¹ In 2 large series of double-blind, placebo-controlled food challenges, chicken meat accounted for only 6 of 426 (1.4%) positive challenges.¹ None of the reported anaphylactic deaths from food allergies have been caused by chicken.^{2,3} Allergy to turkey is even less common,¹ and we are not aware of any previous reports of allergy to game birds. We present 3 patients allergic to various fowl and game birds.

Abbreviation used

TBS: Tris-buffered saline

CASE REPORTS

Three military recruits were referred to the allergy clinic because they required yellow fever vaccine for entry into the United States Marine Corps, and the referring physicians were concerned about their histories of chicken allergy. All 3 patients reported that they ate chicken eggs without any reaction.

Patient 1 is a 19-year-old man who reported that if he eats chicken or turkey, in about 5 minutes he has itching of his mouth, hives, nausea, vomiting, and shortness of breath. He reported that this had happened not only with chicken and turkey but with dove, quail, and pheasant as well. He denied ever having eaten duck or goose.

Patient 2 is an 18-year-old man who reports that if he eats turkey, chicken, or duck, within minutes he has itching all over his body, swelling of the eyes and lips, and throat swelling to the point of shortness of breath. He denied ever having eaten dove, quail, goose, or pheasant.

Patient 3 is an 18-year-old man who reports that if he eats chicken, turkey, dove, or duck, in about 10 minutes he has throat swelling to the point of difficulty breathing and hives all over his body. He denied having ever eaten quail, goose, or pheasant.

METHODS

Skin tests were performed, with results recorded in 15 minutes as millimeters of wheal/millimeters of erythema. Commercial extracts were used for chicken, turkey, and egg (Bayer Allergy Products, Spokane, Wash). Crude dove and quail extracts were prepared from fresh frozen birds by pulverizing the meat in a few milliliters of saline with a mortar and pestle. Freshly reconstituted yellow fever vaccine (Connaught, Swiftwater, Pa) was used at full strength for skin prick tests and diluted 1:10 and 1:100 for intradermal skin tests. All skin tests were prick tests, except for intradermal tests to yellow fever vaccine in patient 3. Four control subjects had no history of any food allergy. Three of the 4 had previously been immunized with yellow fever vaccine.

Protein electrophoresis was performed by using the same materials as used for skin testing for chicken, turkey, dove, and quail. Specimens of duck and goose were also used.

Specimens of dove, quail, goose, and duck were extracted (1:10 wt/vol) in PBS overnight at 4°C. Solid material was removed by centrifugation at 2000 rpm in a Sorvall tabletop centrifuge. The supernatant was collected, placed in aliquots, and stored frozen at -80°C. Protein concentrations were determined by the bicinchoninic acid (Pierce, Rockford, Ill) method and adjusted to 1.0 mg/mL in Laemmli sample buffer with 10 mmol/L dithiothreitol (Sigma, St Louis, Mo) heated to 95°C for 3 to 5 minutes, and 10 to 20 µL of each extract were applied to wells of 4% to 20% gradient gels (Novex, San Diego, Calif) for SDS-PAGE. The gels were run at 20 mA/gel until the tracking reached the bottom of the gel and stopped, and the gels were either stained with colloidal blue (Novex) or were prepared for blotting to NitroPure nitrocellulose

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TABLE I. Skin prick tests (mm wheal/mm erythema)

	Patient 1	Patient 2	Patient 3	Control subjects
Histamine	4/10	6/17	3/35	
Saline	0	0	0	
Chicken	4/32	4/30	4/36	
Turkey	4/21	6/38	3/16	
Dove	3/31	6/42	3/38	0
Quail	3/5	9/65	6/40	0
Egg	0	0	0	
Yellow fever vaccine	3/12	4/45	0 (ID: 1:100 5/22; 1:10 11/40)	0

transfer membranes (MSI, Inc, Westborough, Mass) by using the Novex system. Gels were dried and stored, nitrocellulose blots were blocked with Tris-buffered saline (TBS)/0.05% Tween 20/1% BSA for 1 hour at room temperature, and serum was added 1:1 in TBS overnight at 4°C. Membranes were then washed 5 times in TBS/Tween and incubated for 2 to 4 hours with radiolabeled anti-IgE (Sanofi Diagnostics, Chaska, Minn), washed again, and then exposed to x-ray film (X-Omat; Kodak, Rochester, NY) for 8 to 16 hours at -80°C. The x-ray films were developed in an automatic developer.

RESULTS

Skin prick test responses were positive (wheal ≥ 3 mm with erythema) to chicken, turkey, dove, and quail in all 3 patients. All 3 patients had negative skin test responses to egg. Patients 1 and 2 had positive skin prick test responses to full-strength yellow fever vaccine. Patient 3 had a negative skin prick test response to full-strength yellow fever vaccine but a positive intradermal skin test response to the vaccine diluted 1:100 and 1:10. After testing, each patient was successfully administered the vaccine in graded doses.⁴ Skin test results are summarized in Table I.

Protein electrophoresis demonstrated numerous protein bands present in all bird meats (some of common molecular weight), as well as in egg and yellow fever vaccine (Fig 1).

IgE immunoblotting revealed several IgE bands to proteins of similar molecular weight in chicken, turkey, dove, quail, goose, and duck (Fig 2). The pattern of banding was somewhat different in each patient. None of the 3 patients demonstrated IgE antibody to egg or yellow fever vaccine proteins. Not shown are immunoblots with control serum that showed no banding.

We were not able to perform inhibition immunoassays to further demonstrate cross-reactivity among the various avian allergens because of a low level of IgE binding to solid-phase allergen.

DISCUSSION

Only a few previous reports have described allergy to chicken meat. Hoffman and Ellis⁵ reported on 10 patients with food allergy to chicken as determined by history and RAST results. Two of the 10 subjects were believed to be

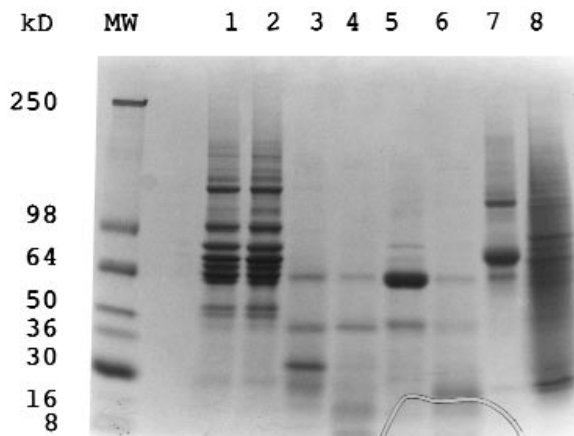


FIG 1. Protein electrophoresis. Lane 1, chicken; lane 2, turkey; lane 3, dove; lane 4, quail; lane 5, goose; lane 6, duck; lane 7, egg; lane 8, yellow fever vaccine. MW, Molecular weight.

allergic to a chicken meat-specific allergen, whereas 8 were believed to be allergic to allergens present in chicken serum. Seven of the 10 subjects also had positive RAST results to egg. Also in 1991, Anibarro Bausela et al⁶ reported on 25 adults allergic to feathers as determined by history and skin test results. Eight of the 25 were allergic to egg, as determined by history, and had positive skin test responses to egg yolk. Three of these 8 subjects were allergic to chicken meat, as determined by history and skin test. Similarly, in 1997, Bausela et al⁷ reported on 27 children sensitized to both egg and feathers. Six of these 27 reported allergic symptoms on ingestion of chicken meat. These patients have been described as having "bird-egg syndrome" because of cross-reacting α -livetins in egg yolk, feathers, and serum.⁸ From these reports,⁵⁻⁷ it would appear that a subset of patients with "bird-egg syndrome" are also allergic to chicken meat, perhaps because of serum proteins in the meat.

In 1997, Liccardi et al⁹ described a patient allergic to chicken meat who was not allergic to egg. They reported that in contrast to patients with bird-egg syndrome, who demonstrated IgE antibody to a 70-kD protein in egg yolk, the patient with isolated chicken meat allergy had IgE antibody to several lower molecular weight proteins in chicken meat. Vila et al¹⁰ also reported on a patient allergic to chicken meat as determined by history and skin test results who was not allergic to egg.

Our patients would appear to fall in this latter category as well (ie, allergic to chicken meat but not to egg). They have positive histories and skin test responses and are positive for IgE antibody to chicken, but they have negative histories and skin test responses and are IgE antibody negative to egg. As with the patient reported by Liccardi,⁹ they produce IgE antibody to several low molecular weight proteins present in chicken meat.

Our patients would appear to be the first reported who are allergic to several avian meats. All 3 claim to have had allergic reactions to any bird meat they had eaten. Skin test responses to not only chicken and turkey but also

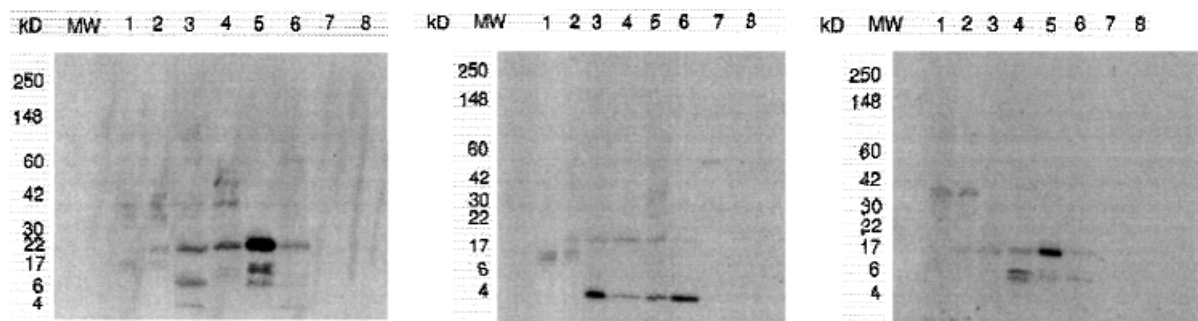


FIG 2. Immunoblots for IgE antibody. Lane 1, chicken; lane 2, turkey; lane 3, dove; lane 4, quail; lane 5, goose; lane 6, duck; lane 7, egg; lane 8, yellow fever vaccine. MW, Molecular weight.

dove and quail were positive in all 3, despite the fact that patients 2 and 3 denied ever having eaten one or both of the game birds. This apparent cross-reactivity is borne out on the immunoblots from all 3 patients. All 3 subjects demonstrated IgE antibodies to several proteins of common molecular weight in all of the bird meats, including those they denied ever having eaten. Interestingly, the banding patterns were somewhat different in each patient.

Yellow fever vaccine is prepared from chicken embryos and may contain residual egg or chicken proteins.¹¹ Despite our patients having positive skin test responses to the vaccine, IgE antibody could not be demonstrated on immunoblot. The explanation for this, as well as any relationship between allergy to avian meat and yellow fever vaccine, remains unclear.

In conclusion, patients allergic to one bird meat may be allergic to others, including game birds, probably because of cross-reacting allergens. Such patients may have to exercise caution, even when eating bird meats they have not previously ingested. The relationship of this allergy to yellow fever vaccine, if any, remains to be determined.

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