

Case report

Occupational allergy to avian proteins presenting as allergy to ingestion of egg yolk

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Occupational respiratory diseases caused by avian proteins have been described by many workers. Hypersensitivity pneumonitis disease has been described from inhalation of proteins from goose and duck,¹ parakeet,² pigeon,³ chicken,⁴ turkey,⁵ dove,⁶ and budgerigar.⁷ In their study of pulmonary responses of bird fanciers, Hargreave and Pepys⁸ have described an asthmatic-like response in a number of subjects. Occupational asthma in poultry workers has been reported to have been caused by spiramycin,⁹ and by poultry mites in a number of workers in Israel.¹⁰ Maat-Bleeker et al.¹¹ have recently described the case of an older woman who developed reactivity with egg yolk coincidentally with the acquisition of a parrot as a household pet. IgE antibodies from this patient demonstrated cross-reactivity between bird sera and egg yolk.

We describe in this article the case of a young woman with occupational exposure to birds who developed symptomatic respiratory allergy to bird proteins and exquisite gastrointestinal sensitivity to egg yolk. By serologic studies, the reactivity to egg yolk is demonstrated to be a result of avian serum sensitization. In addition, the patient is demonstrated to have some specific reactivity to at least two groups of birds.

MATERIAL AND METHODS

Material

Pigeon serum was purchased from Sigma Chemical Co., St. Louis, Mo. Chicken serum was obtained by bleeding a live bantam chicken. Ultrapure egg allergens were those

used in a previous study of egg white allergens.¹² Yolk, white, and yolk protein were prepared from fresh eggs. Chicken meat extract was purchased from Hollister-Stier Laboratories, Spokane, Wash.

RAST

RAST was performed by the standard method used in our laboratory.¹³ Cyanogen bromide-activated disks were coupled to crude extracts at a ratio of 1 ml of 1:10 extract diluted to 7 ml with borate buffer, pH 8.0, per 200 disks. Disks with purified proteins were prepared as previously described.¹² Negative controls included normal horse serum and human sera from patients without egg- or bird-related allergies. RAST inhibition was performed by the methods previously described.¹⁴ Diluted serum was incubated 1 hour with inhibitor or buffer before adding the allergen disk.

Methods

Protein was determined according to the method of Bradford¹⁵ with the Pierce Chemical Co. (Rockford, Ill.) protein reagent. Serum was stored at -20°C until use.

Precipitin tests

Serum was tested for precipitating antibodies against avian proteins by the method described by Fink.¹⁶

RESULTS

Case history

A 31-year-old woman presented to the allergy clinic with the primary complaint of severe allergy to egg and egg-containing products. She reported headache, warmth, and bloating within 30 minutes after ingestion of eggs, baked goods, mayonnaise, or wine, followed by stomach cramps, vomiting, and burning diarrhea lasting up to 6 to 9 hours. She reported having experienced problems with egg for the past 2 years but that the symptoms had become more severe during the past 2 months. History and physical examination indicated that the patient was atopic with perennial allergic rhinitis related to exposure to cats and pollen and also mild asthma. She stated that she had worked with birds "all my life," first with chickens, and that

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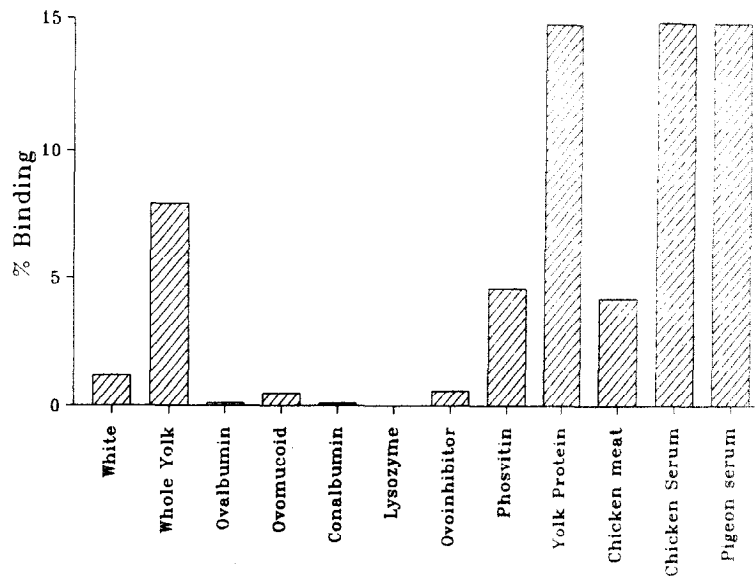


FIG. 1. RAST results to egg fractions, ultrapure egg white allergens, bird sera, and chicken meat. All results are after subtraction of nonallergic control binding.

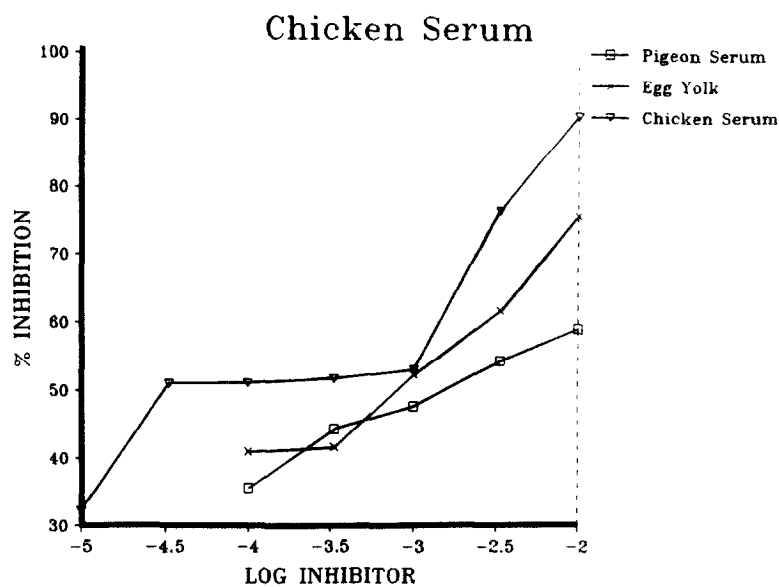


FIG. 2. Inhibition of IgE antibody binding to chicken serum by chicken serum, pigeon serum, and egg yolk. The abscissa demonstrates the dilution of inhibitor added. In this experiment, the homologous inhibition curve is biphasic, indicating that there are two distinct antibody specificities present.

she now raises pheasants, quails, and doves. She also stated that she develops a runny nose and itchy, watery eyes on exposure to the birds. The patient also reported that she smoked a pack of cigarettes per day and that she used epinephrine (Bronkaid; Winthrop-Breon Laboratories, New York, N.Y.) for mild asthma. She was skin test positive to egg, feathers,

cat, and pollens. The remaining medical history was unremarkable.

In later interviews the patient stated that she did not eat poultry any more because she preferred mayonnaise with the poultry and could no longer tolerate egg products. She also stated that she developed respiratory symptoms whenever she handled eggs. In a

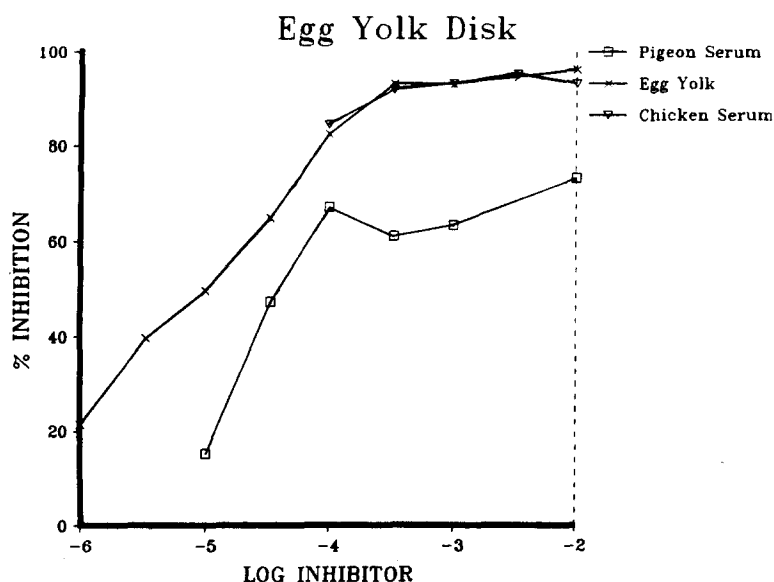


FIG. 3. Inhibition of IgE binding to egg yolk by egg yolk, chicken serum and pigeon serum. The curves for egg yolk and chicken serum are identical and demonstrate essentially complete inhibition of binding. The pigeon serum inhibition curve plateaus at about 60% inhibition.

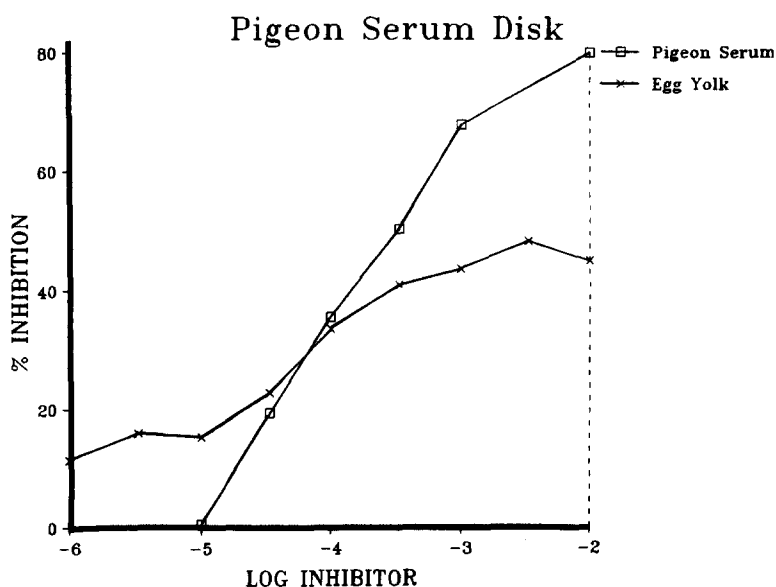


FIG. 4. Inhibition of IgE binding to pigeon serum by pigeon serum and egg yolk. Egg yolk demonstrates only 44% inhibition of binding to pigeon serum, indicating the presence of pigeon serum-specific antibodies.

further interview several months later, the patient stated that she now developed severe asthma within a few minutes of exposure to birds. The symptoms were now so severe that she could not visit her sister who also kept birds or go into a pet store. She has decided to give up raising birds.

No ingestion challenges were attempted because of

the protracted course of symptoms reported after eating even minute quantities of egg-containing products. Inhalation challenges were not performed.

Laboratory studies

The RAST results obtained with this patient's serum are illustrated in Fig. 1. Strong IgE binding activity

was observed to egg yolk, chicken serum, and pigeon serum. Significant reactivity was present to chicken meat extract and to phosvitin, a fraction of yolk. There was a weak reactivity to egg white and the purified proteins, ovomucoid and ovomucoid, with no reactivity found to ovalbumin, conalbumin, or lysozyme.

Inhibition studies were performed with yolk protein, chicken serum, and pigeon serum. The inhibition of IgE binding to chicken serum is illustrated in Fig. 2. Chicken serum was found to be a potent inhibitor, although the shape of the curve suggests a biphasic pattern of inhibition. Egg yolk was a somewhat less potent inhibitor, and pigeon serum elicited much less inhibition. Fig. 3 illustrates the inhibition of binding to egg yolk. In this case, the inhibitor curves for both chicken serum and egg yolk are identical, and both elicit almost complete inhibition. Pigeon serum elicits only about 70% inhibition of binding to egg yolk. The inhibition of binding to pigeon serum is illustrated in Fig. 4. Pigeon serum elicits potent inhibition, whereas egg yolk can only inhibit to about 50%.

No precipitating antibody was found to avian sera when the patient's serum was tested at several concentrations of antigen.

These studies indicate that the patient's primary sensitization is to serum antigens, since the chicken serum is such a potent and complete inhibitor of binding to yolk, whereas yolk is not as potent an inhibitor of binding to chicken serum as serum. The patient also appears to have some independent sensitization to pigeon antigens, since cross-inhibition between pigeon and chicken is not complete. This is consistent with exposure history, since the patient raises doves, which are in the same family as pigeons. It should also be noted that pheasants and quail are in the order Galliformes with chickens and were not tested separately in this study.

DISCUSSION

Avian proteins are well recognized as causes of occupational allergic diseases.¹⁻¹¹ The most commonly reported presentation is hypersensitivity pneumonitis¹⁻⁷; however, asthmatic responses have also been reported.⁸ Antibiotics used in husbandry⁹ and mites that infest the birds¹⁰ have also been reported to cause occupational asthma in the poultry industry. Maat-Bleeker et al.¹¹ have reported one case of a lady who acquired a pet parrot and subsequently developed egg yolk allergy.

The case we have described is unusual in several respects. The young woman had a lifetime exposure to birds and, after many years, developed an exquisite food allergy to egg yolk, as well as asthma and allergic

rhinitis-conjunctivitis on exposure to the birds. There were no other unusual aspects to this patient's history. RAST-inhibition studies suggested that sensitization was to serum proteins; serum could completely inhibit IgE binding to egg yolk, whereas yolk was not as potent an inhibitor of binding to chicken serum as was the serum itself. RAST inhibition also demonstrated some independent sensitivity to serum proteins of the pigeon family, consistent with the patient's history of exposure to doves. As can be observed in Figs. 2 and 3, both egg yolk and chicken serum are almost complete inhibitors of IgE binding to egg yolk, whereas egg yolk is not as potent an inhibitor of binding to chicken serum as is chicken serum. It can be observed in Figs. 2, 3, and 4 that chicken serum and egg yolk are not completely cross-reactive with pigeon serum. The plateau effect observed in Fig. 2 was obtained reproducibly and suggests the presence of more than one antigen. Similar effects can be observed with partially cross-reactive venom allergens.¹²

Although in some ways this case is similar to the one described by Maat-Bleeker et al.,¹¹ there are several significant differences. This patient appears to have originally been sensitized by exposure to chickens in an occupational setting. IgE antibodies were demonstrated in serum that did not completely cross-react between two orders of birds to which the patient had been exposed. No detectable IgG precipitating antibody was found in either case, and both patients had upper respiratory symptoms on bird exposure as well as food allergy to egg yolk.

Although it is well-known that almost all patients with food allergy to egg are reactive to white proteins,¹² it is of clinical value to test patients with a history of bird exposure with both egg yolk and bird serum. Egg yolk is well-known to contain significant quantities of serum proteins. In fact, one company sells antibodies raised in hens prepared by fractionation of their egg yolks. Edwards et al.¹³ have reported that workers exposed to egg spray in a factory that dried egg yolk commonly have IgG precipitating antibodies against egg yolk, but do not have specific IgE antibodies, suggesting that sensitization by egg yolk may be uncommon. An epidemiologic study of workers involved in raising poultry would be necessary to determine if this were really a rare disease or just a rarely reported allergy.

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