

Egg protein sensitization in patients with bird feather allergy

B. AÑIBARRO BAUSELA, M. MARTÍN ÉSTEBAN, F. MARTÍNEZ ALZAMORA, C. PAS-CUAL MARCOS & J. A. OJEDA CASAS

Allergology Service, "La Paz" Hospital, Madrid, Spain

We have studied the hypersensitivity to hen's egg protein and chicken meat in 25 adults with a previous diagnosis of bronchial asthma and rhinoconjunctivitis due to bird feather sensitization. Seventeen of the 25 reported good tolerance to the ingestion of egg and chicken meat. The skin tests were negative to both antigens in 15 of them, and positive for egg in two. All 17 patients had negative RAST to chicken meat and egg protein. The remaining eight patients had intolerance to egg, and three of them also to chicken meat ingestion; in seven of the eight cases allergic to egg, the alimentary intolerance began after the clinical symptoms of bird feather sensitization. In all eight cases the skin tests were positive to egg yolk, and in five of them also to egg white and chicken meat. These patients evidenced specific serum IgE antibodies to egg yolk, four of them to egg white, and seven to chicken meat. These results demonstrate the high frequency (32%) of the association of sensitization to egg proteins, particularly egg yolk, in a selected population of patients with known allergy to bird feathers, thus suggesting that in some patients feather sensitization could trigger or somehow facilitate the later sensitization to egg yolk proteins.

Key words: bird allergy; egg hypersensitivity; feathers; food allergy.

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Egg protein allergy usually appears during the first stages of life, often during the first and second years, and abates and may even disappear, although specific IgE antibodies may still be present in the phase of clinical tolerance (5, 9).

The major route for sensitization seems to be the digestive (9), sometimes even through the mother's breast milk (9); however, there have been reports of sensitization through transplacental passage (9, 17) and occasionally of sensitization due to inhalation of egg material (2, 9).

In the typical forms of egg allergy in infancy, the most allergic part is the egg white (5, 9), and particularly ovalbumin (OVA) and ovomucoid (OVM) (7, 10, 11, 21). Less attention has been paid to egg yolk proteins as allergens (9, 21). Recently, Walsh et al. (23) have suggested

that apovitellins I and VI might behave as major allergens in some patients. Further, specific IgG antibodies to soluble yolk proteins (called livetins) have been detected in workers who developed occupational asthma after exposure to egg spray (2).

Precipitating antibodies to serum antigens of avian species with cross-reactivity to soluble egg yolk proteins have also been demonstrated in patients with extrinsic allergy alveolitis (3).

The occurrence of egg protein sensitization in adults is much less frequent. Some cases have been recently reported in which this hypersensitivity could have been induced or facilitated by a previous inhalatory sensitization to avian antigens, probably due to cross-reactivity between avian antigens and egg proteins (4, 8, 14, 15, 16, 18, 20).

Table 1

Clinical data from the eight patients with simultaneous sensitization to feathers and egg proteins

Patients No.	1	2	3	4	5	6	7	8
Exposure to birds	+	+	+	+	+	+	+	+
Symptoms from feathers	A, RC	A	A	A, RC	A	A	A	A
Egg-related symptoms								
cutaneous	P, AE	P	P, W	U	A	P, AE	AE	P, W
digestive	V, N	V, N	N, D	-	-	-	-	-
Symptoms from chicken meat	P, AE	U	P	-	-	-	-	-
Initial sensitization	feathers	egg	feathers	feathers	feathers	feathers	feathers	feathers
Time interval (years)*	0.5	13	3	3	5	2	3	1

P: labial-pharyngeal pruritus; AE: angioedema; U: urticaria; N: nausea; W: warmth; V: vomiting; D: diarrhea; A: asthma; RC: rhinoconjunctivitis.

*Time interval between date of diagnosis of feather sensitization and date of diagnosis of egg sensitization.

Mandallaz et al. (16) have shown that the main avian antigens with cross-reactivity to egg antigens are present in egg yolk livetins. These workers are also the only ones to suggest the possibility of the reverse phenomenon, i.e. that previous sensitization to egg proteins might secondarily facilitate a later inhalatory sensitization to avian antigens upon sufficient exposure.

We have studied the incidence of egg protein sensitization in a group of patients with established immediate-type hypersensitivity to bird feathers.

MATERIAL AND METHODS

The study population comprised 25 adults (16 women and 9 men; mean age 27 years), with a diagnosis of allergic asthma and/or rhinoconjunctivitis with bird feather sensitization as established by clinical history and positive immediate skin tests ($\geq 3+$) and specific IgE antibodies to the feathers of various avian species. In these patients, we recorded clinical symptoms and positive skin tests, and specific IgE and IgG antibodies to egg proteins and chicken meat.

The skin tests were performed by single prick tests with the following antigens: mixed feathers (chicken and duck, Bencard) 0.5% w/v, chicken meat (Dome/Hollister-Stier) 1/10 w/v, egg white (Dome/Hollister-Stier) 1/20 w/v, egg yolk (Dome/Hollister-Stier) 1/20 w/v, OVA (10 mg/ml) and OVM (10 mg/ml). Positive prick tests were defined as a wheal equal (3 +)

or larger (4 +) than the positive histamine (10 mg/ml) control wheal.

The specific IgG antibodies were assessed by Phadezym-RAST (Pharmacia Diagnostics). Results class 2 or higher were regarded positive.

The specific IgG antibodies to OVA and OVM were assessed by ELISA in polystyrene microplates according to standard methods (22).

RESULTS

All 25 patients reported habitual or sporadic contact with some type of bird (hens, canaries or parakeets). All except one (to be discussed later) had tolerated eggs before the diagnosis of avian antigen sensitization, even during infancy and childhood. No patient was sensitized to other food allergens of non-avian origin.

At the time of the study, 17 patients still had good clinical tolerance to eggs, between 2 and 9 years (with a mean of 3.7 years) after the diagnosis of bird feather sensitization. None of these patients had symptoms related to the ingestion of chicken meat. The skin tests with chicken meat were negative in all 17, and those with egg proteins (white and yolk) were positive in only two, with negative RAST in both cases.

The remaining eight patients reported some type of immediate symptomatology in relation to cooked egg ingestion (all noted symptoms within 30 min of consuming a small amount of a fried egg yolk): labial pruritus (4 cases), nausea (3 cases), labial angioedema (3 cases), immediate vomiting (2 cases), pharyngeal prur-

itus and local hyperthermia (2 cases), asthma (1 case), urticaria (1 case) and diarrhoea (1 case) (Table 1). In all patients, with the exception of Case 2, the bird feather sensitization chronologically preceded the appearance of symptoms after egg ingestion, the time interval ranging from months to years (Table 1).

Case 2 is the only exception, as this patient had had alimentary egg allergy since the age of 7 months, and asthma in relation to bird feathers occurred in adult age, after several years of exposure. As shown in Table 2, this is the only case in the series with strongly positive skin tests and RAST to all egg fractions as well as to feathers and chicken meat.

Only three of the eight patients with egg-related symptoms described any type of symptomatology associated with chicken meat ingestion (labial pruritus in 2, urticaria in 1 and angioedema in 1).

All patients with symptoms after egg ingestion, had positive skin tests to egg yolk (Table 2). Five of them also had positive skin tests to egg white protein (2 to whole white, 1 to white and OVA, 1 to white, OVA and OVM, and 1 to OVA alone). The prick test with chicken meat was positive in five of these eight patients (Table 2).

In concordance with the skin tests, increased levels of specific IgE antibodies were seen in all eight patients for egg yolk, in four for egg white and in seven for chicken meat (Table 2).

The investigation of specific IgG antibodies to OVA and OVM was negative in all cases.

There were no significant differences between the eight egg-sensitized patients and the 17 non-egg-sensitized in regard to associated sensitizations (3 of 8 egg-sensitized patients and 5 of 17 non-egg-sensitized had simultaneous sensitization to pollens) and to serum total IgE concentration (mean values 354.6 IU/ml in the eight egg-allergics and 352 IU/ml in the 17 non-egg-allergics). No patients showed signs of atopic dermatitis.

DISCUSSION

Avian proteins are well recognized as causes of occupational allergic disease (6, 13). Besides hypersensitivity pneumonitis (3, 19), the most frequent manifestations are asthma and rhinoconjunctivitis (3, 6).

The existence of cross-reactivity between serum proteins (mainly albumins and globulins) of various avian species is also known (14). However, cross-reactivity between avian pro-

Table 2

Immunological data from the eight patients with simultaneous sensitization to feathers and egg proteins

Patient No.	1	2	3	4	5	6	7	8	Positive/Total
Prick-tests*									
Mixed feathers	4+	4+	4+	3+	3+	4+	4+	3+	8/8
Egg yolk	4+	4+	4+	4+	4+	4+	4+	4+	8/8
Egg white	3+	4+	3+	-	-	-	-	4+	4/8
OVA	-	4+	-	3+	-	-	ND	3+	3/7
OVM	-	4+	-	-	-	-	ND	-	1/7
Chicken meat	3+	4+	3+	-	-	3+	3+	-	5/8
Specific IgE**									
Chicken feathers	3	4	4	2	3	3	2	2	8/8
Canary feathers	ND	2	ND	3	ND	3	2	3	5/5
Parakeet feathers	ND	3	3	1	ND	ND	1	ND	2/4
Egg yolk	2	4	3	2	3	3	2	2	8/8
Egg white	2	4	4	0	2	0	1	4	4/8
Chicken meat	2	4	2	2	2	2	2	1	7/8

* positive $\geq 3+$.

**results of class ≥ 2 were considered positive.

ND: not done.

teins and hen's egg proteins is less well documented (14, 18, 20, 24).

Maat-Bleeker et al. (14) reported the first case of alimentary egg allergy in a 65-year-old woman in conjunction with the development of asthma and conjunctivitis after acquiring a budgerigar. This patient had specific IgE antibodies to egg yolk and avian proteins, but not to egg white; this finding suggested the presence of cross-reactivity between avian serum proteins and proteins from the soluble fraction of egg yolk, i.e. livetin.

A second case of similar characteristics was reported by Hoffman (8). More recently, Mandallaz et al. (16), through studies of RAST inhibition, have shown that the main antigens with cross-reactivity between avian proteins and egg proteins are present in the livetins of egg yolk, and coined the term "bird-egg syndrome" for the presence of simultaneous sensitization to avian proteins and egg yolk proteins.

In the light of our findings, coincident sensitization to avian and egg proteins is a rather common finding (32% in our series).

In the eight patients with simultaneous sensitization to bird feathers and egg proteins, the most frequent sensitization, both in skin tests and RAST, was not to egg white, as in the typical forms of egg allergy in infancy, but to egg yolk. These results agree with those of other authors (4, 8, 14, 15, 16).

All our patients reported contact with some type of bird, and their clinical histories suggest that their respiratory sensitization to avian antigens preceded the onset of symptoms of egg protein intolerance, suggesting that bird feather sensitization might have triggered or at least facilitated the later sensitization to egg proteins.

There was only one exception (Case 2), in which the egg protein sensitization preceded the bird feather-related asthma.

This relationship is less well documented and should be further investigated, as, if proven, the sustained contact with birds might have influenced the persistence of the egg allergy over the years.

Seven of our patients had positive RAST to chicken meat; five of them also had positive skin tests, but only three reported symptoms after its ingestion. These results may indicate the pre-

sence of sensitization without clinical symptoms to chicken meat in some feather-allergic patients, perhaps due to the existence of antigens common to chicken meat and bird feathers (12, 18, 20, 24). The chicken meat antigens might have cross-reactivity with egg yolk antigens, as suggested by the high frequency of associated specific IgE antibodies to both these antigens in our egg-allergic patients.

In the first reported cases of this association (4, 8, 13, 14, 15, 16) the skin tests to egg white were negative. In our series, five of the eight patients with egg-related symptoms had positive prick tests to whole egg white or to some of its fractions. This sensitization can be explained in Case 2 (Tables 1 and 2) by the presence of a typical form of egg allergy during childhood, with the high positivity to egg white usual in these cases. In the remaining four patients, the positive tests with egg white might be due to cross-reactivity between egg white and antigens from egg yolk and from avian serum proteins and meat, as previously suggested by Langeland (12).

The clinical implications of these observations are still unclear. It is not known whether to recommend an egg- and chicken-free diet to patients sensitized to bird feathers, further to avoiding exposure, or whether it might be beneficial for egg-allergic patients with persistent symptoms to avoid exposure to birds.

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Address:

Dr. Manuel Martín Esteban
Hospital Infantil "La Paz"
Servicio de Alergia
Castellana 261
28046 Madrid
Spain

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