

Skin-test reactivity to egg protein—exposure by inhalation compared with ingestion

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Summary

Of two hundred and sixty-seven subjects exposed to egg by ingestion only, forty-eight were skin (prick)-test positive to egg material. All forty-eight subjects also reacted to other allergens on skin testing, forty-seven (98%) to allergens associated with respiratory allergy.

Of thirteen subjects exposed to egg by inhalation in their workplace (and ingestion) two were skin-test-positive to egg, both also reacting to respirable allergens.

Thus, inhalation of egg antigen does not greatly influence skin-test reactivity to eggs as determined by comparing the ratio of egg skin-test-positives to total skin-test-positives in the egg groups ingesting and inhaling egg antigen, i.e. 48:218 *vs* 2:6.

In terms of the pulmonary response to inhaled eggs there were equal numbers of symptomatics with positive skin tests to common allergens as there were symptomatics with negative skin tests. Thus, an allergic predisposition shown by a positive skin test to common allergens does not predict nor preclude development of a pulmonary reaction to inhaled egg material.

Introduction

Respiratory symptoms are the most common manifestation of hypersensitivity. Although figures vary worldwide (Aaronson, 1972) an estimated 10% of the population of U.S.A. are affected by inhaled allergens (Lane & Storr, 1979). Symptoms such as rhinitis, asthma and hay fever are seen with the severity of response being governed by factors such as the amount of material inhaled and the degree of sensitization of the individual (Connell & Sherman, 1963). The ingestion of allergens by susceptible people may also lead to responses (Berrens, van Dijk & Weemaes, 1981) ranging from diarrhoea, nausea, or both, to more systemic reactions such as urticaria

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and anaphylaxis. Most allergens are either inhaled or ingested, thus there is little information on the immunological response in man to the same material encountered by both routes of exposure.

An opportunity to compare the effects of inhalation and ingestion of the same allergen on the development of skin-test reactivity arose when we studied a group of confectionery workers exposed to an egg-protein aerosol.

Materials and methods

Subjects exposed to eggs by inhalation

A group of thirteen confectionery workers used a diluted egg and water mixture sprayed on to meat rolls as a glaze prior to cooking. They were exposed to the egg-protein aerosol for up to 75 min/day, and after several months (mean 15.5 ± 10.6) eight of these developed immediate-type respiratory symptoms (Edwards *et al.*, 1983). All subjects were skin-prick-tested with egg white and yolk at 1/10 and 1/100 in saline and with common respirable allergens—housedust, housedust mite, grass and tree pollens, cat's fur and *Aspergillus fumigatus* (Bencard). They were also tested with the common food allergens—milk, wheat and potato. An oedematous reaction 2 mm greater than the control at 10–15 min was taken as a positive result.

Subjects exposed to egg by ingestion

Two hundred and sixty-seven subjects referred to the Asthma Research Unit, Sully Hospital, Penarth, South Wales were skin-prick-tested for reactivity to egg protein. All had been in contact with eggs only by ingestion. Additional skin tests to respirable and food allergens were made as for the confectionery workers.

Results

When exposure to eggs was solely by ingestion, all persons with positive skin-test reactions to egg also had positive skin-test reactions to other allergens. This particularly applies to the respirable allergen group where 98% (47/48) skin-test-positive to egg were also skin-test-positive to inhaled allergens, and to a lesser extent 79% (39/48) to ingested allergens (Table 1).

When exposure was by inhalation (and ingestion) 2/13 workers were skin-test-positive to egg; both of these also positive to other inhaled allergens, one to food allergens.

The presence or absence of skin reaction to eggs bore no relationship to the development of symptoms to egg after inhalation since only one of the two egg skin-test-positives had experienced symptoms after inhaling egg, and of the eleven that were skin-test-negative to egg, seven were symptomatic. Skin testing showed three of these to be positive to inhalable allergens, two also to ingestible allergens (Table 1).

Discussion

All subjects skin-test-positive to egg were also positive to one or more other inhaled (98%) or ingested (79%) allergens. Similar results were obtained by Langeland (1983) in patients allergic to egg by ingestion. He commented that egg allergy may be an indicator of a high degree of atopy and, therefore, a bad prognostic sign for atopic disease. Other studies—e.g. May *et al.* (1977) using an increased range of food allergen extracts (up to twenty)—reported all skin-test egg positives to react to one or more

Table 1. Skin-test reactions to common respirable and ingestible allergens in a group of 267 subjects exposed to eggs solely by ingestion compared with reactions in thirteen confectionery workers exposed to eggs by inhalation

		Skin-test-positive to other allergens		Negative to other allergens
		(a) Ingestible allergens	(b) Inhalable allergens	
Exposed to egg by ingestion	(n = 267)			
Skin-test-positive to egg	(n = 48)	39	47	0
Skin-test-negative to egg	(n = 219)	82	146	49
Exposed to egg by inhalation	(n = 13)			
Skin-test-positive to egg	(n = 2)	1	2 (1)	0
Skin-test-negative to egg	(n = 11)	2	4 (3)	7 (4)

Figures in parentheses refer to confectionery workers symptomatic to egg exposure.

other food allergens (53/53 tested). In contrast the pulmonary reactivity to inhaled egg is not related to the allergic predisposition of the individual because there were an equal number of symptomatic subjects skin-test-negative to common allergens as there were symptomatic persons positive to common allergens. We observed similar findings in animal handlers allergy (Cockcroft *et al.*, 1981) where twenty-one of forty-nine handlers with symptoms were atopic as judged by their skin-test reactivity to common allergens, the remaining twenty-eight did not react to common allergens.

The failure to detect skin-test reactivity even in symptomatic subjects is contrary to most allergic states caused by respiratory allergens but is not unknown. Huggins & Brostoff (1975) reported six cases with a positive provocative nasal challenge to housedust mite in skin-test-negative subjects. The allergic reactivity in these cases was apparently confined to the nose with no systemic release of IgE to produce a skin reaction. These results suggest that the gastrointestinal tract and lung differ in response to allergen exposure; the gastrointestinal tract mediating tolerance to antigens with systemic hypersensitivity to ingested material occurring with tolerance breakdown, and the pulmonary system inducing localized immunity with systemic hypersensitivity occurring when the local system is overloaded, as described experimentally by Hunninhake & Fauci (1977). Our investigation on exposure to egg protein shows that inhalation does not lead to increased skin-test reactivity to egg since there was no great increase in the number of skin-test egg positives if the ratio of egg positives to all skin-test positives in the egg-ingested group (48:218) is compared with the ratio in the confectionery workers (2:6).

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