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ORIGINAL ARTICLE

Laboratorial characteristics of patients with diarrhoea suffering from egg white allergy

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Abstract
Background: Egg allergy is associated with diarrhoeal symptoms. However, the mechanism underlying allergic diarrhoea remains unclear.
Objective: To determine whether egg white-specific IgE antibodies coexist with egg white-specific IgG antibodies in patients with egg allergy featuring diarrhoeal symptoms, and whether there is any relationship between these two antibody types.
Methods: A total of 89 patients with egg allergy featuring diarrhoeal symptoms (average age, 23.2 years; range, 1–78 years), all of whom tested positive for egg white-specific IgG, were enrolled in this study. The concentration of total IgE, egg white-specific IgE and number of eosinophils in the serum were determined.
Results: Among the 89 egg white allergic patients tested, 49 (55.1%) patients showed high reactivity to egg white-specific IgG, 48 (53.9%) patients had elevated serum total IgE levels, and 25 (28.1%) patients had elevated absolute eosinophil numbers. Out of the 89 egg white allergic patients, 25 showed elevated egg white-specific IgE antibody levels. Of the 25 patients who were positive for egg white-specific IgE antibody, 21 presented high sensitive reaction to egg white-specific IgG, three presented moderate sensitive reaction to egg white-specific IgG, and one presented mild sensitive reaction to egg white-specific IgG. A moderate correlation between egg white-specific IgG and egg white-specific IgE, egg white-specific IgG and absolute eosinophil number was found in the egg white allergic patients ($r = 0.438$, $P = 0.000$; $r = 0.322$, $P = 0.002$). Egg white-specific IgE levels varied in different age groups; the egg white-specific IgE concentration of younger patients (age $\leq$ 18 years, mean rank 54.29) was significantly higher than that of the adult patients (age > 18 years, mean rank 34.61) ($Z = -3.629$, $P = 0.000$).
Conclusion: Egg white-specific IgE antibody could coexist with egg white-specific IgG antibody in patients suffering from egg white allergy. Aberrant changes in the concentration of egg white-specific IgE antibody were associated with the presence of egg white-specific IgG antibody.

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Introduction

Food allergies affect approximately 1–10.8% of the general population, and their prevalence seems to be increasing.[1] Egg is one of the most common food allergens. Egg white is the most important source of allergens in the egg, and it contains 23 different proteins.[2] Ovomucoid, ovalbumin, ovotransferrin and lysozyme have been defined as the major allergens in egg white.[3] A high concentration of ovomucoid-specific IgE has been associated with persistent egg white allergy.[4] Another study reported that allergy was associated with more intense IgA and IgG responses to ovalbumin.[5] Previous work in our laboratory showed that cow's milk-specific IgE antibody could coexist with cow's milk-specific IgG antibody in patients suffering from cow's milk allergy. Aberrant changes in the concentration of cow's milk-specific IgE antibody were associated with the presence of cow's milk-specific IgG antibody.[6] We wished to determine whether this phenomenon also occurred in egg white allergic patients with diarrhoeal symptoms. Here, we studied the concentration changes in total IgE, egg white-specific IgE antibody, egg white-specific IgG antibody and eosinophil number in the peripheral blood of egg white allergic patients with diarrhoeal symptoms in the Zhongshan Hospital of the Medical College of Xiamen from November 2009 to September 2010. We further investigated whether there were any relationships between the two antibody types.

Materials and methods

Patients

A total of 89 egg white allergic patients (average age, 23.2 years; range, 1–78 years; 53 males and 36 females) who sought medical advice for diarrhoea from November 2009 to September 2010 were diagnosed at the Department of Digestive Health of Xiamen Zhongshan Hospital. The clinical diagnosis of egg white allergy was made following international guidelines.[7,8] The detailed characteristics of the investigated study groups are shown in Table 1. All patients tested positive for specific IgG against egg white. A group of 45 healthy subjects (average age, 26.1 years; range, 1–70 years; 24 males and 21 females) was also recruited. All subjects completed questionnaires regarding gastrointestinal symptoms and egg consumption. The study was approved by the local Research Ethics Committee, and informed consent was obtained from all participants. It was in compliance with the national legislation and Declaration of Helsinki guidelines.

Table 1 Clinical characterisation of the study groups.

Number of patients with egg white allergy	89
Average age (years)	23.2 (1–78)
Male/Female	53/36
Mean introduction time of egg white (days)	1–8
Specific IgG to egg white (range, U/mL), positive rate (%)	51.0–948.4 (100%)[a]
Specific IgE to egg white (range, U/mL), positive rate (%)	0–35.6 (28.1%)[a]
Total IgE (range, ng/mL), positive rate (%)	5.8–7896.0 (53.9%)[a]
Number of controls	45
Average age (years)	26.1 (1–70)
Male/Female	24/21
Mean introduction time of egg white (days)	–
Specific IgG to egg white (range, U/mL), positive rate (%)	0–55.0 (4.4%)
Specific IgE to egg white (range, U/mL), positive rate (%)	0–0.4 (2.2%)
Total IgE (range, ng/mL), positive rate (%)	6.27–152 (2.2%)

[a] The proportion of specific IgG to egg white, specific IgE to egg white, and total IgE were significantly higher than the control ($P = 0.000$). Fisher's Exact Test was used to determine the significant differences across groups.

Measurement of egg white-specific IgG antibody in the serum

Blood samples (4 mL) were drawn from all subjects. The blood samples were allowed to stand for 20–30 min before centrifugation at 3000 rpm for 15 min. The serum was aspirated and frozen at −80 °C for subsequent analysis. Samples were processed in the central laboratory (Xiamen Zhongshan Hospital, China) using a commercially available enzyme-linked immunosorbent KIT (ELISA, Biomerica, Inc. Newport Beach, CA, USA). The protocol was performed according to the instructions provided with the ELISA kit. Egg white-specific IgG < 50 U/mL was considered negative; IgG concentrations between 50 U/mL and 100 U/mL were considered to indicate mild sensitivity; IgG concentrations between 100 and 200 U/mL were considered to indicate moderate sensitivity; and IgG concentrations >200 U/mL were considered to indicate high sensitivity.

Measurement of egg white-specific IgE antibody in the serum

The egg white-specific IgE antibody in the serum was measured using an ELISA kit (DR. FOOKE Laboratorien GmbH, Germany). Egg white-specific IgE < 0.35 U/mL was considered negative; IgE concentrations between 0.35 and 0.7 U/mL were considered to indicate a weak reaction; IgE concentrations between 0.7 and 3.5 U/mL were considered to indicate a moderate reaction; and IgE concentrations >3.5 U/mL were considered to indicate a strong reaction.

Total IgE and eosinophils determination

Total IgE and eosinophils were measured as described in our earlier study.[6]

Statistical analysis

All statistical analyses were conducted using SPSS for Windows version 17. The data were expressed as the