

# Demographics and clinical characteristic of patients diagnosed with hen's egg allergy

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## Abstract

**Aim:** To assess the demographics, clinical characteristics and natural course of patients diagnosed with hen's egg allergy.

**Material and Methods:** Patients who were diagnosed with hen's egg allergy were included in this study. The patients' medical records were analyzed to collect demographic and clinical data.

**Result:** 88 patients diagnosed with hen's egg allergy were included in the study. 46 (52.3%) of the patients were male, their median age was 33 months and their median follow-up period was 18 months. 44 (50%) of the patients had comorbid atopic disease. 49 (55.7%) of the children's parents had a diagnosis of atopic disease, while 5 (5.7 %) had a diagnosis of food allergy. In terms of the patients' clinical symptoms, 86 (97.7%) had cutaneous symptoms, 16 (18.2%) had gastrointestinal system symptoms, 13 (14.8%) had respiratory system symptoms. In the follow-up, 43 (48.9%) of the patients were found to develop tolerance. When the patients allergic to egg white and those allergic to egg yolk were compared in terms of clinical findings, atopic eczema exacerbation was found to be more frequent ( $p=0.012$ ) in patients allergic to egg white; while urticaria ( $p=0.005$ ) and cough ( $p=0.012$ ) were found to be more frequent in patients allergic to egg yolk.

**Conclusion:** In clinical presentations that develop as a result of egg allergy, the most frequent symptoms are dermatological, gastrointestinal system and respiratory system symptoms, respectively. However, while atopic eczema exacerbations are more frequent in patients allergic to egg white, symptoms related with respiratory tract are more common in patients allergic to egg yolk.

**Keywords:** Allergy; Cow's Milk; Persistence; Predictive Factors; Tolerance.

## INTRODUCTION

Diagnosis of a food allergy is associated with a significant deterioration in quality of life. Cow's milk allergy and hen's egg allergy are major and common food allergies among infants aging <1 year. Studies in Western countries have indicated that hen's egg allergy represents the second most prevalent allergen during infancy and early childhood following cow's milk (1-3). Whereas studies from Japan and China reported that hen's egg allergy was the most frequently recognized food allergy (4,5). These allergies diminish with age, indicating that tolerance develops with age. The estimated prevalence of hen's egg allergy is 2% among children aged 1-3 years in the United Kingdom (6) and 1.8% among children aged 1-5 years in the United States (7). Hen's egg allergy prognosis varies

in different studies. In some studies, 66-74% of hen's egg allergy cases were reported to outgrow their allergy by the age of 5 years (8,9). In contrast, another study found that only 12% of hen's egg allergy cases outgrew their allergy by the age of 6 years and 48% by 12 years (10). These studies show that the prognosis of hen's egg allergy is not necessarily good.

The aim of the current analysis was to assess the demographics, clinical characteristic and natural course of patients diagnosed with hen's egg allergy.

## MATERIAL and METHODS

### Study design

Patients diagnosed with hen's egg allergy who were admitted to the Pediatric Allergy and Immunology

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Department at three teaching and research hospitals (Inonu University Faculty of Medicine, Medeniyet University Faculty of Medicine, and the GOP Taksim Education and Research Hospital) from June 2013 to June 2018 were included in that study. The diagnosis of hen's egg allergy was based on the resolution of symptoms with hen's egg elimination from the children's diet (or the mothers diet, in case of breastfed children) followed by the return of symptoms on oral hen's egg challenge. The challenge was carried out with 0.5 gr of egg white for the first step of oral provocation test. The tolerance was based on a negative open oral hen's egg challenge followed by regular ingestion of age appropriate quantities of hen's egg at home without any symptoms. The diagnosis of Ig E-mediated hen's egg allergy was considered in children who developed allergic symptoms within 2 h of exposure to hen's egg on Oral Food Challenge (OFC) and showed evidence for sensitization to hen's egg as detected by skin prick testing and/or serum-specific Ig E for hen's egg. Non-Ig E-mediated hen's egg was considered in children with typical symptoms developed more than 8 h after exposure to hen's egg. Children were followed up twice a year until development of tolerance to hen's egg.

The patients' medical records which are complete were analyzed to collect demographic and clinical data. These included; age, gender, duration of follow up, breast feeding at least for 6 months, monthly family income, pets in the home, exposure to cigarettes, history of co-atopic disease (atopic eczema, recurrent wheeze, drug allergy), having other food allergy, history of family atopic disease and food allergy, sensitization to food allergens other than hen's egg, type of reaction, clinical manifestations of hen's egg and laboratory findings.

The research protocol was approved by the Ethics Committee of Inonu University Faculty of Medicine. All participants provided written informed consent.

### Data analysis

Statistical analyses were performed using the SPSS software (ver. 15; SPSS Inc., Chicago, IL, USA). Kolmogorov-Smirnov test was used to assess the samples' homogeneity. Categorical variables were compared using a chi-squared test and quantitative variables were compared using the Mann-Whitney U-test. A two-sided  $p < 0.05$  was considered to indicate statistical significance.

## RESULTS

88 patients diagnosed with hen's egg allergy were included in the study. 46 (52.3%) of the patients were males, their median age was 33 months (min-max: 6-120) and their median follow-up period was 18 months (min-max:10-54). 49 (55.7%) of the patients had been diagnosed before 12 months old. 54 (61.3%) of the patients were found to be allergic to egg white, 34 (38.7%) were found to be allergic to egg yolk. 44 (50%) of the patients had comorbid atopic disease (atopic eczema; 39.2%, recurrent wheezing; 33%, drug allergy; 7.8%), 9 (10.2%) had comorbid food allergy

other than hen's egg (6 cow's milk, one nuts and 2 legumes). 49 (55.7%) of the children's parents had a diagnosis of atopic disease, while 5 (5.7%) had a diagnosis of food allergy. 74 (84.1%) of the patients had been breastfed. 9 (10.2%) of the patients had a pet at home and 31 (35.2%) had been exposed to cigarette smoke (table 1) 83 (94.3%) of the patients' reactions were Ig E mediated. In terms of the patients' clinical symptoms, 86 (97.7%) had cutaneous symptoms (urticaria; 69.3%, pruritus; 45.5%, angioedema; 11.4%, flushing; 6.8%, flare of atopic eczema; 35.2%), 16 (18.2%) had gastrointestinal system symptoms (vomiting; 11.4%, diarrhea-proctocolitis; 10.2%, discomfort; 3.4%, constipation; 1.1%), 13 (14.8%) had respiratory system symptoms (cough; 8%, tachypnea; 3.4%, wheezing; 4.5%, stridor; 1.1%, rhinitis; 4.5%).

**Table 1. Demographic findings of the hen's egg allergy**

Demographics	n (%)
Gender, male	46 (52.3)
Age of onset of symptoms > 6 month,	12 (2-80)
Follow up duration, median (min-max), month	18 (12-54)
Other co-atopic diseases	44 (50)
Atopic eczema	25 (39.2)
Recurrent wheeze	29 (33)
Drug allergy	4 (7.8)
Family atopy history	49 (55.7)
Family food allergy history	5 (5.7)
Other food allergies	9 (10.2)
Sensitization to other foods	46 (52.3)
Breast feeding $\geq$ 6 months	74 (84.1)
Monthly income < 1000 \$	65 (73.9)
Pet in home	9 (10.2)
Exposure to cigarettes	31 (35.2)
Clinical symptoms within 2 hour	71 (80.7)
Type of reaction	
Ig E- mediated	83 (94.3)
Non Ig-E mediated	9 (10.2)
Mix	31(35.2)

In the follow-up, 43 (48.9%) of the patients were found to develop tolerance. 16 (47.1%) of the patients allergic to egg yolk were found to develop tolerance, and 27 (50%) of the patients allergic to egg white were found to develop tolerance.

When the patients allergic to egg white and those allergic to egg yolk were compared in terms of clinical findings, atopic eczema exacerbation was found to be more frequent ( $p=0.012$ ) in patients allergic to egg white; but urticaria ( $p=0.005$ ) and cough ( $p=0.012$ ) were found to be more frequent in patients allergic to egg yolk. In terms of laboratory analyses, while there was no difference between total Ig E level ( $p=0.975$ ), specific Ig E level at the moment of diagnosis was found to be higher in patients allergic to egg white ( $p=0.008$ ) (Table 2).

**Table 2. Comparison of clinical symptoms and laboratory results between egg white allergy group and egg yolk allergy group by univariate analysis**

Clinical symptoms	Egg white group: 54	Egg yolk group: 34	p-value
	n (%)	n (%)	
<b>Cutaneous</b>	52 (96.3)	34 (100)	0.520
Urticaria	31 (57.4)	30 (88.2)	0.005
Pruritus	26 (48.1)	14 (41.2)	0.675
Angioedema	6 (11.1)	4 (11.8)	1.00
Flushing	4 (7.4)	2 (5.9)	1.00
Atopic eczema exacerbation	25 (46.3)	6 (17.6)	0.012
<b>Gastrointestinal</b>	11 (20.4)	5 (14.7)	0.699
Vomiting	6 (11.1)	4 (11.8)	1.00
Diarrhoea-proctocolitis	8 (14.8)	1 (2.9)	0.145
Discomfort	3 (5.6)	-	NC
Constipation	1 (1.9)	-	NC
<b>Respiratory</b>	4 (7.4)	9 (26.5)	0.028
Cough	1 (1.9)	6 (17.6)	0.012
Tachypnea	3 (5.6)	-	NC
Stridor	1 (1.9)	-	NC
Wheezing	2 (3.7)	2 (5.9)	0.638
Rhinitis	2 (3.7)	2 (5.9)	0.638
<b>Anaphylaxis</b>	1 (1.9)	-	NC
<b>Laboratory</b>			
Total Ig E, median (min-max)	96.7 (4.25-1320)	102 (2.85-893)	0.975
Initial food sIg E > 5, IU/L	22 (40.7)	4 (11.8)	0.008
Eosinophil > %4	33 (61.1)	16 (47.1)	0.284

## DISCUSSION

In this manuscript which examined the demographic and clinical characteristics of children with hen's egg allergy, allergic reaction that developed for egg yolk was shown to be more commonly type I mediated, while allergic reactions that developed for egg white were shown to be type I mediated, and type IV mediated reactions also were commonly seen. While dermatological symptom atopic eczema exacerbation was found to be more frequent in patients allergic to egg white, respiratory tract related symptoms were found to be more frequent in patients allergic to egg yolk. In addition, sIg E antibody titer, which develops against proteins, was found to be higher in egg white when compared with egg yolk.

Egg protein allergy or sensitization has been associated with an increased risk of suffering than other allergic disorders. In their study, Echeverria et al (11) reported

that over 93% of the patients also presented with atopic dermatitis (71.2%), asthma (58.4%) and allergic rhinitis (48.5%). Similarly, atopic disease accompanied hen's egg allergy in half of the patients in our study.

Egg allergy is the leading food allergy in infant period. Most of the clinical symptoms that develop due to egg allergy present with skin involvement. Most of the dermatological symptoms are Ig E mediated reaction type, such as urticaria. Gastrointestinal and respiratory system symptoms follow dermatological symptoms. In our study, almost all of the egg-induced reactions had dermatological symptoms. This was followed by gastrointestinal and respiratory system symptoms, respectively.

Five major allergens have been characterized in hen's egg, which are designated as Gal d 1–5. Egg white contains several allergenic proteins, including ovomucoid (Gal d 1; 11%), ovalbumin or conalbumin (Gal d 2, 55%), ovotransferrin (Gal d 3, 12%), lysozyme (Gal d 4, 3%) and ovomucin (4%) (12). Ovomucoid has been shown to be the immunodominant protein in egg white (13,14). Chicken serum albumin (Gal d 5) is the major allergen in egg yolk and is thought to be involved in the pathogenesis of bird egg syndrome and immediate reaction (15,16). In our study, the result that respiratory tract involvement was higher in patients allergic to egg yolk can be explained with allergy that develops against chicken serum albumin protein of egg yolk.

Egg sensitization is closely associated with atopic dermatitis, particularly in infants who developed eczema in the first year of life (17–19). Egg-sensitized children have been shown to have more severe and persistent dermatitis, and the level of sensitization has been shown to be correlated with the severity of the disease (17,19). Proteins such as ovalbumin and ovomucoid in egg white cause more skin symptoms. In our study, atopic eczema exacerbations were found to occur more in patients allergic to egg white and sIg E antibody titers that developed for egg white were found to be higher.

The prognosis of egg allergy is generally considered to be good because it is thought that most children will outgrow it as they become older. Egg allergy usually develops within the first 2 years of life and resolves in 52% of individuals by 3 years of age and in 66% by 5 years of age (8). The mean follow-up period of our study was 18 months and tolerance was found to develop in half of the patients during this period.

Our study had few limitations that could influence the results. First, since the study was retrospective, patients whose files were not complete were excluded. Second, follow-up periods of the patients were short.

## CONCLUSION

As a conclusion, egg allergy presents in early periods of life and tolerance development is delayed. In clinical presentations that develop as a result of egg allergy, the most frequent symptoms are dermatological,

gastrointestinal and respiratory system symptoms, respectively. However, while atopic eczema exacerbations are more frequent in patients allergic to egg white, symptoms related to respiratory tract are more common in patients allergic to egg yolk.

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