

# Egg Allergy in Jeddah City – Saudi Arabia

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## Abstract

**Background:** Egg is a major part of daily food. Egg hypersensitivity (EH) is a common problem. It's mainly due to IgE mediated type I hypersensitivity reaction.

**Objective:** to determine which clinical allergic diseases are associated more with EH.

**Methods:** This paper was performed on 143 patients during 2021 in Jeddah city. Only positive RAST sIgEs results to egg white or yellow were included. RAST results were taken from patient files retrospectively. Additionally, the associated allergic diseases were taken. RAST machine used was from Mediwiss German company which is an ELISA system. Results were collected in an Excel sheet. RAST results were correlated to clinical symptoms. Four tables were extracted.

**Results:** EH in adults in Jeddah is more common in males 85 (59.4%) than females 56 (39%), and more common in white egg 54 (37.8%) than yellow egg 28 (19.5%). Additionally, EH in Jeddah city is commonest in age of thirties, 40 (28%) and adulthood, 31 (21.7%). Most common allergic diseases which are associated with EH are: allergic rhinosinusitis, atopic dermatitis, asthma and food allergy respectively. EH class is mostly of mild severity.

**Conclusions:** EH in Jeddah city has several characteristics. It's more common in adults (especially males) in the age period between 20-40 years, and more common to white than yellow egg. Common allergic diseases associated with EH are allergic rhinosinusitis, atopic dermatitis, asthma and food allergy respectively. EH severity is mostly of mild class; however, this must be correlated with the clinical findings.

**Key words:** egg white allergy, egg white sensitization, asthma, allergic rhinitis, atopic dermatitis

## Introduction

Type I hypersensitivity reaction is dependent on IgE secretion against triggering allergen. This reaction is immediate and may happen after 15 minutes to several hours. Appearance of allergic symptoms shortly after allergen exposure is crucial for this reaction history and considered as the cornerstone. Health professionals must ask about the duration between allergen exposure and the start of allergic symptoms. Patients can link easily as the time is short between the two occasions. This part of information makes the diagnosis of type I hypersensitivity reaction easy. EH is type I immediate hypersensitivity and happens a short time after eating egg (1).

Type I hypersensitivity reaction happens against egg proteins only. Egg white is the major source of egg proteins however, egg yellow has few. That is why type I hypersensitivity may happen with both white and yellow egg part. Egg white proteins are: ovomucoid (Gal d 1), ovalbumin (Gal d 2), ovotransferrin (Gal d 3), lysozyme (Gal d 4). Egg yellow protein is alpha-livetin (Gal d 5). The principal protein amount is ovalbumin, while the key allergenic protein is ovomucoid. That is why EH happens most commonly to ovomucoid. This means that the epitope structure is more important than the protein amount in triggering IgE mediated reactions (2).

High sIgE blood level (or positive skin prick test) to egg proteins without any clinical symptoms is called egg sensitization (not egg allergy). Egg sensitization alone isn't enough to start egg avoidance. Many infants are sensitized to egg proteins (not allergic to egg proteins). That is why detailed history is the key factor not laboratory tests. Health professionals must ask about the allergic symptoms which are associated with egg proteins sensitization. These allergic symptoms associated with egg proteins may appear in any system like skin, lung, GIT and respiratory system. Some mothers of egg sensitization infants do read laboratory results themselves and stop giving egg to their infants needlessly! Health professionals must educate mothers that this is considered as malpractice and may harm the infant's nutrition intake. Mothers must take the advice of stopping egg to their children from health professionals related to this field only (3).

Egg allergy is mainly a disease of infancy. Egg allergy in infants is a significant cause for further allergies in future if not treated early. In a prospective study in the UK, 981 egg allergy children were followed since birth up to four years. It was noticed that most of egg allergy infants will develop respiratory allergies at four years of age especially if they have eczema. Additionally, if not treated early, they will develop sensitization to inhalant allergens at four years. That is why it is essential to advise early egg avoidance in any infant with egg allergy (to sensitization) to prevent future drawbacks. Moreover, it's important to do in vitro RAST blood test to detect high sIgE levels against white or yellow egg proteins in any suspicious child (4).

## Methods

This research was performed during the year 2021. It is a retrospective study which included only positive in vitro lab results of high sIgE levels against either white or yellow egg proteins. The sample of this scientific article was 143 positive in vitro lab results to egg proteins. Test used was in vitro RAST food blood test. It is a test of indirect immunofluorescence which measures the radioactivity to egg proteins (white or yellow). High radioactivity to egg proteins means high sIgE level to one of them (white or yellow) and is considered as a positive result. Positive results to either white or yellow egg proteins or to both were included in the study. RAST results were taken from the laboratory of a private allergy center in Jeddah city.

Allergic diseases diagnosis was added to this article's variables. Positive egg proteins in vitro blood results alone are egg sensitization only. Egg sensitization alone is of no clinical importance. That's why it is crucial to add the allergic diseases diagnosis with this research article. The combination of in vitro lab results plus the clinical allergic diagnosis is important to differentiate between atopy and allergy. Any positive egg sensitization result which is associated with any allergic disease diagnosis was considered as egg allergy. All patients were from Jeddah city in Saudi Arabia.

The RAST machine used the indirect immunofluorescence technique. This machine is from MEDIWISS Analytic GmbH company which is run by RIDA® system. It uses an electronic reader which can read the radioactivity level to allergens which will appear on digital picture in RIDA® X-Screen or RIDA® maXi-Screen. Level of radioactivity was measured by the reader. If radioactivity to certain allergens is high over a certain limit this was considered as positive sensitization. This machine mentioned in this article is used to measure the radioactivity level to egg white or egg yellow proteins.

Results of both positive in vitro results to egg proteins plus allergic diseases diagnosis was collected in an Excel sheet. File numbers, age, sex of patients was added to excel sheet also. Four tables were extracted. Table-1 is about the demography of egg allergy in Jeddah city and was extracted from the column of patient's age. Table-2 relates to the age intervals of patients with egg allergy and was taken from the age column. This table will clarify which age interval that egg allergy is most common in. Table-3 is about the common clinical allergic diseases which are associated with egg sensitization. This table is important to define which allergic disease that egg proteins sensitization can trigger. Table-4 is about the different grade levels of egg sensitization severity. This table may reflect the most common level of egg sensitization in Jeddah city; however, this must be correlated with clinical findings.

## Results

(Table-1) is about the demography of EH to both (white, yellow). EH in males is double that in females as 85 (59.4%), and 56 (39%) respectively. Egg white hypersensitivity is twice the egg yellow hypersensitivity as (37.8, 19.5%) respectively. Hypersensitivity to both white and yellow is nearly the same as egg white hypersensitivity (41.3%, 37.8%) respectively. These findings show that EH is more in males than females, and more in egg white or both in white and yellow.

**Table 1: Gender distribution of egg hypersensitivity (EH)**

	Female	Male	Total
White only	23 (16%)	31 (21.7%)	54 (37.8%)
Yellow only	15 (10.5%)	13 (9%)	28 (19.5%)
Both	18 (12.6%)	41 (28.7%)	59 (41.3%)
Total	56 (39%)	85 (59.4%)	

Table-2 shows prevalence of EH throughout age periods. Age of thirties, and age of adulthood which ranges between (20-40 years) are approximately 50% of cases. Commonest age period is age of thirties (30-40 years) and 40 (28%), followed by age of adulthood (20-30 years) as 31 (21.7%). Next common age intervals are middle age (40-50 years) as 23 (16%), infancy (0-1 year) as 16 (11.2%), childhood and early adulthood (10-20) as 14 (9.8%) respectively. EH is rare in late middle age and the elderly. These findings show that age of thirties and adulthood are the commonest for EH.

**Table 2: EH distribution according to age periods**

Age Periods	Age period name	Number of cases	%
0-10	Infancy	16	11.2
10-20	Childhood, early adult	14	9.8
20-30	Adulthood	31	21.7
30-40	Thirties	40	28
40-50	Middle age	23	16
50-60	Late middle age	10	7
≥60	Elderly	9	6.3

Table-3 is about common allergic diseases which are associated with EH. These diseases are associated with EH in three levels. The first level commonest allergic diseases linked to EH are allergic rhinosinusitis 56 (39.2%) followed by atopic dermatitis 48 (33.6%). Second level is asthma 36 (25.2%) and food allergy 34 (23.8%). Third and last level is urticaria and angioedema 26 (18.2%). Other clinical allergies like drug allergy, contact dermatitis, allergic conjunctivitis and anaphylaxis are rarely linked to EH.

**Table 3: Which clinical allergies are more prevalent with EH?**

	Number of cases	%	Level of association with EH
Allergic rhinitis, sinusitis	56	39.2	First level
Atopic dermatitis	48	33.6	
Asthma	36	25.2	Second level
Food allergy	34	23.8	
Urticaria, Angioedema	26	18.2	Third level
Drug Allergy	3	11.2	Rarely associated with EH
Contact dermatitis	7		
Allergic conjunctivitis	5		
Anaphylaxis	1		

Table-4 displays score severity of EH results. Positive results for EH are more common in egg white 113 (79%) than egg yellow 78 (60.8%). Commonest grade severity is in the interval of 1-3 as 83 (58%) for egg white, and 61 (42.6%) for egg yellow. This is followed by the grade below 1 as 27 (18.8%) for egg white, and 24 (16.7%) for egg yellow. More severe grades from 3-6 are rare. This means that egg white allergy is more than yellow; most of EH are of mild class. Still history is the cornerstone, and all these data must be connected to clinical findings.

**Table-4: What is the link between AH and score severity?**

Score Severity	Egg white		Egg yellow	
	Number	%	Number	%
≤1	27	18.8	24	16.7
1-3	83	58	61	42.6
3-5	3	2	2	1.4
5-6	0	0	0	0
Total	113	79	87	60.8

## Discussion

Worldwide EH is a problem of infancy. Recent development of EH in adults is less common than infants and if happens it will be severe. However, we find that EH in Jeddah city is common in adults as well as infants. Table-2 show that the commonest age periods in Jeddah city for those who have EH are the age of (thirties, adulthood). This finding can happen because of the huge egg consumption in the age group in Saudi Arabia or because they have had EH since their childhood. This finding in Saudi concludes that adults are commonly sensitized to egg proteins like infants (5).

In Jeddah city, the most common allergic diseases which are associated with EH are rhinosinusitis and atopic dermatitis (Table 3). This result is compatible with the recent evidence, such as British guidelines of egg allergy. Allergic rhinosinusitis which is triggered by egg proteins can prove its relation to food. History is the key here. If allergic rhinosinusitis symptoms start a short time after egg intake this will prove type I IgE mediated hypersensitivity to egg. Rhinitis symptoms are similar to rhinorrhoea, nasal blockage, nose itching and sneezing. Sinusitis symptoms are like postnasal discharge and frontal headache which is aggravated by pending. Mothers are the most important person who can notice this relationship and answer the relevant changes (6).

Children with EH are at a great risk of atopic dermatitis. In a large study done in several European countries, inclusion data was any child between 1-2 years with positive (DBPC) double-blind placebo-controlled egg challenge. 86 infants were positive, and they were matched to 140 controls blindly. Results showed that the connection between EH and atopic dermatitis isn't the only association, but also atopic dermatitis becomes more severe if associated with EH. This means that with any child with atopic dermatitis it is a good idea to search for EH especially if the atopic dermatitis is severe (7).

In Saudi Arabia, atopic dermatitis and EH association is compatible with the European findings. In a retrospective study done in Riyadh city on 421 allergic patients, 60 patients were positive for EH. This means that they have

high sIgE level to egg and chicken meat. 55% of positive samples were atopic dermatitis patients. Allergy to egg white was more than yolk. This association between atopic dermatitis and EH is found more in food allergy patients. This means that in any patient with food allergy and atopic dermatitis it is crucial to search for EH (8).

Egg allergy can be diagnosed in several ways. The most important tool is detailed history. The key point in history taking is the appearance of allergy symptoms shortly after egg intake because this is IgE immediate type I hypersensitivity reaction. Lab tests used for egg allergy diagnosis are either in vitro or in vivo tests. In vivo test is a skin prick test for white or yellow eggs. Positive skin prick test is skin wheal and induration to egg drop, 15 minutes after prick. In vitro test is ELISA system which measures sIgE blood level of white or yellow eggs. Definite egg allergy diagnosis can be made with allergy symptoms appearance shortly after eating egg plus either positive in vivo or in vitro tests for white or yellow egg(9).

In most of the cases, egg allergy diagnosis is clear by history and lab tests. However, in a few cases diagnosis is still vague (ex: contradictions between history and tests). In these cases, we need to do oral egg challenge test. Here we admit the patient to a one day care unit which is already prepared with all requirements for anaphylaxis. We used to give the patient gradually increasing oral egg doses and we monitor the response and vital signs. Positive oral egg challenge test is a significant diagnosis. Positive oral egg challenge is allergy symptoms appearance soon after egg eating. If any symptoms of anaphylaxis appear, patient will be given suitable anaphylaxis drugs immediately (10).

Egg avoidance is the primary main treatment of egg allergy especially in eczematous children. In a randomized study performed in the UK, 55 eczematous children were advised to avoid egg. They were randomized against control group with no egg avoidance advice. After 4 weeks of follow up, it was noticed that eczematous areas were decreased in children who avoided egg in comparison to children who didn't. This can give a clear message that egg avoidance advice can benefit most eczematous children. Empirical avoidance for one month and monitoring child eczema is logical thinking(11).

In most of the cases, egg allergy can be relieved on simple egg avoidance. However, in a few cases improvement will not happen and referral to a dietician is needed. Other indications of referral to dietician are severe egg allergy symptoms, multiple food allergies or if there is a plan to reintroduce egg. Dietician roles are to educate mothers about foods which don't contain egg, to clarify which vitamins and minerals are needed with egg avoidance and to supervise the process of egg reintroduction. Egg is present in many foods and nutrients and mothers must be well educated about this issue (12).

Most egg allergy cases will be alleviated by egg avoidance, but in a few resistant cases we will need egg sublingual immunotherapy. It's a new promising treatment modality. When sublingual drops are absorbed, it will go to local lymph nodes, the place where the process of immunological modulation happens. With time, egg tolerance will replace the egg allergy cascade. Egg immunotherapy is given as loading and maintenance doses. Loading doses are frequent daily doses which build up quickly in a few months course. Maintenance doses are distance fixed doses that will continue for several years. Egg tolerance will happen after several years. This means that patients can eat egg without any allergic symptoms (13).

#### **What is the prognosis of egg allergy?**

The answer is that most of egg allergy children will tolerate egg gradually with time. In a USA retrospective study, egg tolerance was considered to be if child can tolerate pure oral egg without allergy symptoms. After setting inclusion criteria, many children's files were revised. Children files review showed that as they get older, they will tolerate egg better. However, there are a few resistant cases which will not improve with time like those who have continuous high sIgE levels to egg or those who have concomitant allergic diseases especially food allergies. sIgE levels against egg can be used for monitoring, as a prognostic factor and for parents' education (14).

Are child vaccines which include egg as part of their constituents, advised to be given to a child with egg allergy or not? Is there any risk of anaphylaxis? Child vaccines which include egg are MMR, influenza and yellow fever. Our role as health professionals is to emphasize to parents that their child with egg allergy should take these vaccines in most cases and their conservative avoidance is harmful and should stop. However, any child with severe egg allergy symptoms or who have had previous anaphylaxis should avoid these vaccines. There are some studies which suggest that skin prick test to egg can be done before taking the vaccine (15).

#### **What about breastfeeding of child with egg allergy, is it advisable or not?**

The answer is that it's a mistake to avoid breastfeeding and shift to artificial milk just because a child is allergic to egg! Health professionals must clarify this to mothers in clear messages that they must continue breastfeeding. Can egg be secreted in mothers breast milk or not? Mothers who breastfed an egg allergy child must avoid eating egg or not? The point we can emphasize is that mothers should

avoid egg eating if their child has atopic dermatitis or if the child has developed any previous reaction to egg or its products (16).

### Conclusions

EH in Jeddah city has several characteristics. It's more common in adults (especially males) in the age period between 20-40 years, and more common to white than yellow egg. Common allergic diseases associated with EH are allergic rhinosinusitis, atopic dermatitis, asthma and food allergy respectively. EH severity is mostly of mild class; however, this must be correlated with the clinical findings.

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