Allergol Immunopathol (Madr). 2025;53(1):32-39
eISSN:1578-1267, pISSN:0301-0546

Allergologia et immunopathologia
Sociedad Española de Inmunología Clínica, Alergología y Asma Pediátrica
www.all-imm.com

ORIGINAL ARTICLE

The Role of Basophil Activation Test in the Diagnosis of Pediatric Egg Allergy in Turkey: A Comparison of Clinical and Laboratory Findings with Real-Life Data

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Received 5 August 2024; Accepted 7 October 2024
Available online 1 January 2025

KEYWORDS
basophil activation test;
egg allergy;
oral provocation test;
skin prick test;
spIgE

Abstract
Background: Egg allergy is among the most common food allergies in children, significantly affecting the dietary habits and quality of life of both the affected children and their families. This study aims to assess the clinical role of the Basophil Activation Test (BAT) in children with egg allergy and to evaluate its diagnostic accuracy in comparison to other tests.
Methods: The study included 46 children with egg allergy. Patients were classified into three groups: IgE-mediated, non-IgE-mediated, and mixed-type allergies. Each patient underwent a Skin Prick Test, serum-specific IgE test, BAT, and Oral Food Challenge. The sensitivity and specificity of each diagnostic test were evaluated.
Results: Egg SpIgE positivity was observed in all patients with IgE-mediated allergy (100%) and in 77.78% of those with mixed-type allergy, while only 47.1% of patients with non-IgE-mediated allergy were positive ($p = 0.008$). BAT positivity was significantly higher in IgE-mediated (72.7%) and mixed-type allergies (50.0%) compared to non-IgE-mediated allergies (17.6%) ($p = 0.013$). Compared to the oral provocation test, Egg SpIgE had a sensitivity of 0.73 and specificity of 0.33, BAT had a sensitivity of 0.46 and specificity of 0.67, and SPT had a sensitivity of 0.44 and specificity of 0.60. Although Egg SpIgE demonstrated the highest sensitivity, its low specificity makes it less reliable for accurately identifying non-allergic individuals. In contrast, BAT, with its highest specificity and moderate sensitivity, aligns more closely with the oral provocation test in accurately diagnosing egg allergy.
Conclusion: When comparing the positivity rates of Egg SpIgE, BAT, and SPT according to allergy types, IgE-mediated allergies showed significantly higher positivity rates. BAT demonstrated high specificity and moderate sensitivity in both IgE-mediated and mixed-type

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https://doi.org/10.15586/aei.v53i1.1187

allergies, making it the most compatible test with the oral provocation test for the accurate diagnosis of egg allergy. Given that this test is currently used only for research purposes in our country, it is recommended that BAT be more widely adopted in clinical practice in accordance with guideline recommendations.

Introduction

Egg allergy is one of the most common food allergies in children, with a global prevalence ranging from 1.3% to 10.1%. This rate is higher in infants and tends to decrease with age.[1,2] Symptoms of egg allergy can range from mild skin rashes to severe anaphylactic reactions, significantly affecting the dietary habits and quality of life of affected children. However, adhering to an elimination diet can be challenging and may lead to inadequate or deficient nutrition, especially when multiple food allergies are present. Furthermore, accidental ingestion of the allergen is not uncommon, posing a risk of life-threatening reactions.[3]

Studies on children with egg allergy show that the allergy is typically classified as IgE-mediated, non-IgE-mediated, or mixed-type (involving both mechanisms). This classification is crucial for determining treatment approaches and long-term prognosis. Among the various tests used for diagnosis and management, egg-specific IgE (SpIgE), Skin Prick Test (SPT), Basophil Activation Test (BAT), and Oral Food Challenge (OFC) are significant. The double-blind, placebo-controlled oral food challenge (DBPCFC) is considered the gold standard for diagnosing food allergies; however, in clinical practice, especially with children, the open OFC is the most commonly used method. When the OFC is negative, it allows the reintroduction of the food into the diet. However, it poses risks for the child (including the possibility of anaphylaxis), is expensive, time-consuming, and can sometimes be challenging to perform and interpret, often relying on the clinician's discretion.[3]

In the latest update of the European Academy of Allergy and Clinical Immunology (EAACI) guidelines on the diagnosis of IgE-mediated food allergy, published last year, BAT was included for the first time among the recommended tests. It is suggested before an OFC in patients with suspected food allergy where SPT and specific IgE (sIgE) measurements are inconclusive.[4] Additionally, BAT is valuable as a non-invasive alternative in cases where an oral food challenge should be avoided, especially in patients at risk of severe allergic reactions. BAT also plays an important role in determining the patient's sensitivity to specific allergens and the severity of allergic reactions. This helps establish the allergy threshold and predict how much allergen patients can tolerate.[5] This test measures the activation of basophils and the expression of specific proteins (CD63 and CD203c) when IgE antibodies on the surface of basophils bind to allergens. BAT has both high sensitivity (77-98%) and high specificity (75–100%), making it a reliable diagnostic tool.[6]

Current Clinical Applications of BAT

Reducing the need for diagnostic OFC

In clinical practice, BAT can reduce the need for unnecessary diagnostic OFCs for egg allergy. BAT provides a clearer diagnosis, especially in patients with ambiguous SPT and sIgE results.[7]

Determining the risk of severe reactions

BAT can help identify children with egg allergy who are at risk of severe reactions. Higher basophil activation is associated with more severe reactions.[7]

Assessing tolerance

BAT can be used to distinguish children who tolerate cooked eggs, allowing for the safer inclusion of cooked eggs in their diet and improving their quality of life.[7]

Monitoring ımmunomodulatory treatments

BAT can be used to monitor the effectiveness of immunomodulatory treatments. A decrease in basophil activation may be observed in patients responding to treatment. Our study aims to highlight the potential of this test, which is rarely used in our country, to improve diagnostic accuracy and guide appropriate treatment strategies for egg allergy.[7]

Methods

Patient selection and demographic ınformation

The demographic information of the patients included in the study (age, gender, gestational age, birth weight, mode of delivery), feeding history (age at introduction to complementary feeding, duration of breastfeeding), family history of allergies, and the presence of additional allergic diseases were recorded.

Clinical and laboratory evaluation

Patients were classified as having IgE-mediated, non-IgE-mediated, or mixed-type (mix-type) allergies based on clinical symptoms and laboratory findings.

IgE-mediated allergies

In these allergies, the immune system produces IgE antibodies in response to allergens. Upon re-exposure, these IgE antibodies bind to mast cells, triggering the rapid release of histamine and leading to symptoms such as urticaria (hives), angioedema (swelling), respiratory distress, and anaphylaxis, which can develop within minutes.

Non-IgE-mediated allergies

These allergies do not involve IgE antibodies but are driven by cellular immune responses, such as T-cell activation. Symptoms typically appear hours to days after allergen exposure and primarily affect the gastrointestinal system (e.g., diarrhea, abdominal pain) and skin (e.g., atopic dermatitis).

Mixed-type allergies

Both IgE and non-IgE mechanisms are involved, leading to a combination of immediate symptoms (e.g., urticaria, respiratory distress) and delayed symptoms (e.g., gastrointestinal issues, atopic dermatitis).

During the diagnostic stages, skin prick tests, serum-specific IgE tests, basophil activation tests, elimination diets, and oral food challenges were performed.

Skin prick test (SPT)

In our study, egg solutions were obtained from kits provided by the ALK-Abello company (Hørsholm, Denmark). Application was performed at the recommended standard dosage of a 100 µg/mL concentration. Positive test results were defined according to the recommendations of the European Academy of Allergy and Clinical Immunology. Intradermal test results were considered positive if the difference from the negative control was greater than 3 mm.

Serum specific IgE (sIgE) test

The levels of allergen-specific IgE in serum samples were measured using the ImmunoCAP 1000 system manufactured by Phadia (Sweden). For each serum sample, IgE levels against egg were measured using the ImmunoCAP test kit. The levels of allergen-specific IgE (sIgE) were classified according to a predetermined evaluation scale. Values below 0.35 kU/L were considered negative, while values above 0.35 kU/L were considered positive.

Elimination test

This test involved removing eggs from the patient's diet and then reintroducing them in a controlled environment. The reappearance of symptoms was considered a positive result.

Oral provocation test

This test was conducted as an "open challenge test" according to standard guidelines for cases without a history of anaphylaxis.[8]

Basophil activation test

BATs were performed using Flow CAST (Bühlmann Laboratories AG). Venous blood was collected in 10 mL EDTA tubes and stored at 4°C for no longer than 24 hours. For each patient and allergen, polystyrene tubes were prepared with different concentrations of allergens (egg) diluted in stimulation buffer. The Flow CAST method was used for egg. The cutoff point for CD63 activation was set at 11.5 ng/mL or higher concentrations at ≥10%. Positive controls included monoclonal anti-FcεRI antibody and N-formyl-methionyl-leucine-phenylalanine (2 mM), while the negative control used only the stimulation buffer. Cells were analyzed by flow cytometry using a FACSCalibur flow cytometer (Becton-Dickinson Biosciences GmbH, Heidelberg, Germany). Basophilic cells were selected from the lymphocyte population using anti-CCR3, and the upregulation of the activation marker CD63 was calculated as the percentage of CD63-positive cells in the total basophilic cell population. The cut-off point was set at 10%.

Statistical evaluation

Statistical analysis was conducted using the SPSS 15.0 for Windows program. Descriptive statistics included counts and percentages for categorical variables, as well as the mean, standard deviation, minimum, maximum, and median for numerical variables. The comparison of proportions in independent groups was performed using chi-squared analysis. Since the comparisons of numerical variables did not meet the assumption of normal distribution, the comparison between independent two groups was carried out using the Mann–Whitney U test. Logistic regression analysis was conducted to assess the risk effects of the variables. A statistical alpha level of $p < 0.05$ was considered the threshold for significance, indicating statistical significance.

Ethical committee

Ethical approval for this study was obtained from the Clinical Research Ethics Committee of***Ondokuz Mayıs University (number: 2021000609-1). Our study was conducted in accordance with the principles of good clinical practice based on the Helsinki Declaration. Ethical approval ensures that research studies are conducted in compliance with ethical standards and human rights, and that the rights of participants are protected.

Results

Demographic characteristics of children with egg allergy

The study included 46 children with egg allergy, consisting of 25 males (54.3%) and 21 females (45.7%). Key demographic details include a mean age of 38.7 months, with the majority born at term (91.9%), and a notable cesarean delivery rate of 79.1%. Detailed information is provided in Table 1.

Clinical manifestations of egg allergy: a comprehensive analysis

In our study, when patients with egg allergy were clinically evaluated, atopic dermatitis was observed in 39 patients (84.78%), restlessness in 22 patients (47.83%), persistent diaper rash in 19 patients (41.30%), stagnation in weight gain in 18 patients (39.13%), perianal redness in 15 patients (32.61%), food refusal and mucous stool in 14 patients each (30.43%), colic in 13 patients (28.26%), urticaria in 12 patients (26.09%), diarrhea and vomiting in 11 patients each (23.91%), bloody stool and asthma in 8 patients each (17.39%), angioedema and rhinitis in 6 patients each (13.04%), cough in 5 patients (10.87%), anaphylaxis in 4 patients (8.70%), and constipation in 1 patient (2.17%) (Figure 1).

Allergy development in the patients was classified as IgE-mediated in 11 patients (23.9%), non-IgE-mediated in 17 patients (37.0%), and mixed-type in 18 patients (39.1%). IgE-mediated allergy was more prevalent in females (54.5%), whereas non-IgE-mediated and mixed-type allergies were more prevalent in males (52.9% and 61.1%, respectively). However, the difference in gender distribution among allergy types was not statistically significant ($p = 0.706$). The age of onset of the first symptoms was most frequently in the 4-6 months age group, and the age at first diagnosis was most frequently in the 7-11 months age group across all allergy types. There was no statistically significant difference in the age of onset of first symptoms and age at first diagnosis among the allergy types ($p = 0.231$ and $p = 0.916$, respectively).

Additionally, there were no significant differences among the groups regarding the presence of other allergic diseases, known comorbid conditions, and family history of allergic disease/atopy. The comparison of continuous variables such as age, age at onset of first symptoms, age at first diagnosis, total duration of breastfeeding, duration of diet, and birth weight did not reveal any statistically significant differences among the allergy types in children with egg allergy (all comparisons, $p > 0.05$). However, the

Table 1 Demographic and nutritional characteristics of children with egg allergy.

Categorical variables		n (%)
Gender	female	25 (54,3)
	male	21 (45,7)
Age group (months)	1-24	14 (30,4)
	25-48	20 (43,5)
	> 48	12 (26,1)
Gestational age	Preterm (<37 week)	4 (8,1)
	Term (37-42 week)	40 (91,9)
Birth weight (n=44)	<2500gr	3 (6,8)
	2500-4000gr	38 (86,4)
	>4000gr	3 (6,8)
Mode of delivery (cesarean/normal birth)	cesarean	34 (79,1)
	Normal birth	9 (20,9)

Continuous variables	Mean ±SS	Median (min-max)
Age (months)	38,7±27,8	29,5 (8-120)
Age at onset of first symptoms (months)	5,8 ±3,4	5,5 (1-19)
Age at first diagnosis (months)	9,2± 7,0	8 (1-36)
Age at introduction of complementary feeding (months)	5,8 ±1,3	6,0 (4-12)
Total duration of breastfeeding (months)	13,4±6,0	14,0 (0-24)
Duration of diet (months)	7,7±6,6	6,0 (0-36)

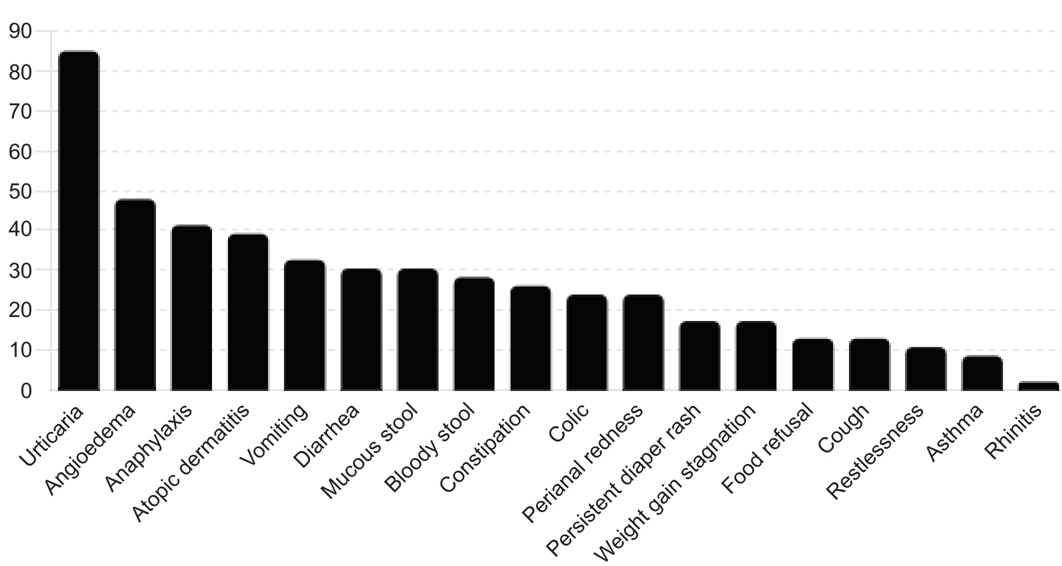

Figure 1 Clinical symptoms of patients with egg allergy.

median age at introduction of complementary feeding was significantly lower in patients with non-IgE-mediated allergy compared to the other groups (p = 0.048) (Table 2).

Evaluation of diagnostic methods for egg allergy: skin prick test, specific IgE, basophil Activation test, and oral food challenge

The positivity (sensitivity) of egg-specific IgE in children with egg allergy was found to be 71.7%, BAT positivity was 43.5%, and SPT positivity was 43.2%. The positivity rates of Egg SpIgE, BAT, and SPT according to allergy types are presented in Table 3. Egg SpIgE positivity was detected in all patients with IgE-mediated allergy (100%) and in 77.78% of those with mixed-type allergy, while only 47.1% of those with non-IgE-mediated allergy showed positivity. The difference between the groups was statistically significant (p = 0.008). BAT positivity was significantly higher in IgE-mediated (72.7%) and mixed-type allergies (50.0%) compared to non-IgE-mediated allergies (17.6%) (p = 0.013). There was no statistically significant difference among the three groups in terms of SPT and provocation test positivity (p = 0.576 and p = 0.130) (Table 3).

When the results of the oral provocation test were compared with those of other allergy tests, no significant differences were found (Table 4). However, the oral provocation test is considered the gold standard. When evaluating the performance of other tests in comparison to it, the sensitivity and specificity were as follows: SpIgE had a sensitivity of 0.73 and a specificity of 0.33, BAT had a sensitivity of 0.46 and a specificity of 0.67, and SPT had a sensitivity of 0.44 and a specificity of 0.60.

Although SpIgE has the highest sensitivity, its low specificity makes it less reliable for accurately identifying non-allergic individuals. In contrast, BAT, with its highest

Table 2 Comparison of continuous variables by allergy type in children with egg allergy.

Variables	Total (n:46) Mean ±SS Median (min-max)	IgE mediated (n:11) Median (min-max)	Non-IgE mediated (n:17) Median (min-max)	Mixed type (n:18) Median (min-max)	p
Age (months)	38,7±27,8 29,5 (8-120)	27,0 (12-53)	29,0 (1-120)	33,5 (8-74)	0,351
Age at onset of first symptoms (months)	5,8±3,4 5,5 (1-19)	6,0 (1-8)	4,0 (1-19)	6,0 (1-12)	0,504
Age at first diagnosis (months)	9,2±7,0 8 (1-36)	8,0 (4-12)	8,0 (3-24)	7 (1-36)	0,757
Age at introduction of complementary feeding (months)	5,8±1,3 6,0 (4-12)	6,0 (-6)	5,0 (4-7)	6,0 (4-7)	**0,048**
Total duration of breastfeeding (months)	13,4±6,0 14,0 (0-24)	18,0 (9-22)	14 (2-24)	13,0 (0-24)	0,175
Duration of diet (months)	7,7±6,6 6,0 (0-36)	6,0 (0-24)	6,0 (0-120)	8,0 (0-36)	0,124
Birth weight (grams)	3285,4±474,0 3275,0 (2150-4800)	3450,0 (2480-4150)	3150,0 (2400-3900)	3300,0 (2150-4800)	0,207

Table 3 Distribution of diagnostic test results and clinical manifestations in egg allergy subtypes.

Variable		Total n (%)	IgE mediated n (%)	Non-IgE mediated n (%)	Mix type n (%)	p
Egg SpIgE	Pozitive	33 (71,7)	11 (100,0)	8 (47,1)	14 (77,8)	**0,008**
	Negative	13 (28,3)	0 (0,0)	9 (52,9)	4 (22,2)	
BAT (Basophil Activation Test)	Pozitive	20 (43,5)	8 (72,7)	3 (17,6)	9 (50,0)	**0,013**
	Negative	26 (56,5)	3 (27,3)	14 (82,4)	9 (50,0)	
Skin Prick Test	Pozitive	16 (43,2)	3 (33,3)	5 (38,5)	8 (53,3)	0,576
	Negative	35 (76,1)	6 (66,7)	8 (61,5)	7 (46,7)	
Oral Provocation Test	Pozitive	37 (80,4)	7 (63,6)	16 (94,1)	14 (77,8)	0,130
	Negative	9 (19,6)	4 (36,4)	1 (5,9)	4 (22,2)	
Skin symptoms	Pozitive	43 (93,5)	11 (100,0)	15 (88,2)	17 (94,4)	0,458
	Negative	3 (6,5)	0 (0,0)	2 (11,8)	1 (5,6)	
Gastrointestinal Symptoms	Pozitive	27 (58,7)	2 (18,2)	13 (76,5)	12 (66,7)	**0,006**
	Negative	19 (41,3)	9 (81,8)	4 (23,5)	6 (33,3)	

specificity and moderate sensitivity, aligns more closely with the oral provocation test in accurately diagnosing egg allergy. Therefore, considering the balance between reducing false positives and maintaining a reasonable detection rate, BAT can be considered the most compatible test with the oral provocation test.

The presence of symptoms and clinical findings in children with egg allergy was compared with the results of allergy tests in Table 5. Among children with skin findings, the positivity of Egg SpIgE was significantly higher (p = 0.019). BAT positivity was significantly higher in those with atopic dermatitis and those who responded to the diet (p = 0.014 for both), while BAT negativity was more common in those with a cough (p = 0.038). Additionally, all patients with angioedema had positive SPT results (p = 0.010).

Among children with positive Egg SpIgE, the median age was significantly lower compared to those with negative Egg SpIgE (p = 0.017), and the duration of the diet was longer (p = 0.049), while there were no significant differences in other parameters. In children with positive SPT, the median duration of the diet was longer (p = 0.023) and the median IgE level was higher (p = 0.022) compared to those with negative SPT, with no significant differences in other parameters. For children with positive BAT, the median age and the age at onset of symptoms were significantly lower compared to those with negative BAT (p = 0.028 and p = 0.026, respectively), while there were no significant differences in other parameters.

Table 4 Comparison of oral food challenge test results with other allergy test results.

Variable		Provakasyon testi		p
		Negative	Pozitive	
Egg SpIgE	Pozitive	6 (66,7)	27 (73,0)	0,698
	Negative	3 (33,3)	10 (27,0)	
BAT (Basophil Activation Test)	Pozitive	3 (33,3)	17 (45,9)	0,711
	Negative	6 (66,7)	20 (54,1)	
Skin Prick Test (SPT)	Pozitive	2 (40,0)	14 (43,8)	1,00
	Negative	3 (60,0)	18 (56,3)	

Discussion

In our region, egg allergy is the second most common allergy after milk allergy.[12] In our study, 46 children with egg allergy were evaluated. Of these patients, 54.3% (25 individuals) were male, and 45.7% (21 individuals) were female. The gender distribution did not show a significant difference according to allergy type. Similarly, the literature indicates that gender is not a determining factor in the development of food allergies.[13] The majority of the patients (91.9%) were born at term, and 86.4% were born weighing between 2500 and 4000 grams. Term birth and appropriate birth weight are important factors for overall health and development in children. This study found a high rate of term births (91.9%). According to the literature, term birth and normal birth weight provide advantages in terms of immunological development and tolerance.[14] However, 79.1% of our patients were born by cesarean section. Research indicates that cesarean birth increases the risk of food allergies. Cesarean delivery can affect the gut microbiota of infants, leading to changes in the immune system.[15] The average age and age at diagnosis of our patients were consistent with the literature. Additionally, the total duration of breastfeeding was, on average,

Table 5 Clinical manifestations of egg allergy based on diagnostic test results.

Variable	Egg SpIgE		p	BAT		p	SPT		p
	Poz +	Neg -		Poz +	Neg -		Poz +	Neg -	
Urticaria	11 (91,7)	1 (8,3)	0,135*	8 (66,7)	4 (33,3)	0,059	5 (50,0)	5 (50,0)	0,716*
Angioedema	5 (83,3)	1 (16,7)	0,659*	3 (50,0)	3 (50,0)	1,00*	5 (100,0)	0 (0,0)	**0,010***
Anaphylaxis	3 (75,0)	1 (25,0)	1,00*	2 (50,0)	2 (50,0)	1,00*	2 (50,0)	2 (50,0)	1,00
Atopic dermatitis	30 (76,9)	9 (23,1)	0,087*	20 (51,3)	19 (48,7)	**0,014**	15 (45,5)	18 (54,5)	0,618
Vomiting	9 (81,8)	2 (18,2)	0,473	6 (54,5)	5 (45,5)	0,49	7 (70,0)	3 (30,0)	0,067
Diarrhea	9 (81,8)	2 (18,2)	0,473	5 (45,5)	6 (54,5)	1,00	7 (63,6)	4 (36,4)	0,151
Mucous stool	11 (78,6)	3 (21,4)	0,724	5 (35,7)	9 (64,3)	0,48	7 (58,3)	5 (41,7)	0,291
Bloody stool	7 (87,5)	1 (12,5)	0,405	3 (37,5)	5 (62,5)	0,71	5 (62,5)	3 (37,5)	0,422
Constipation	1 (100,0)	0 (0,0)	1,00	1 (100,0)	0 (0,0)	0,43	1 (100,0)	0 (0,0)	0,432
Colic	9 (69,2)	4 (30,8)	1,00	4 (30,8)	9 (69,2)	0,27	4 (33,3)	8 (66,7)	0,491
Perianal redness	10 (66,7)	5 (33,3)	0,730	6 (40,0)	9 (60,0)	0,74	6 (42,9)	8 (57,1)	1,00
Persistent diaper rash	13 (68,4)	6 (31,6)	0,746	7 (36,8)	12 (63,2)	0,44	8 (47,1)	9 (52,9)	0,74
Food refusal	9 (64,3)	5 (35,7)	0,493	5 (35,7)	9 (64,3)	0,48	5 (41,7)	7 (58,3)	1,00
Stagnation in weight gain	13 (72,2)	5 (27,8)	1,00	6 (33,3)	12 (66,7)	0,26	8 (50,0)	8 (50,0)	0,519
Cough	2 (40,0)	3 (60,0)	0,128	0 (0,0)	5 (100,0)	**0,038**	0 (0,0)	5 (100,0)	0,057
Restlessness	14 (63,6)	8 (36,4)	0,243	7 (31,8)	15 (68,2)	0,14	7 (36,8)	12 (63,2)	0,419
Asthma	4 (50,0)	4 (50,0)	0,196	1 (12,5)	7 (87,5)	0,11	2 (28,6)	5 (71,4)	0,674
Rhinitis	3 (50,0)	3 (50,0)	0,330	2 (33,3)	4 (66,7)	0,68	1 (16,7)	5 (83,3)	0,206

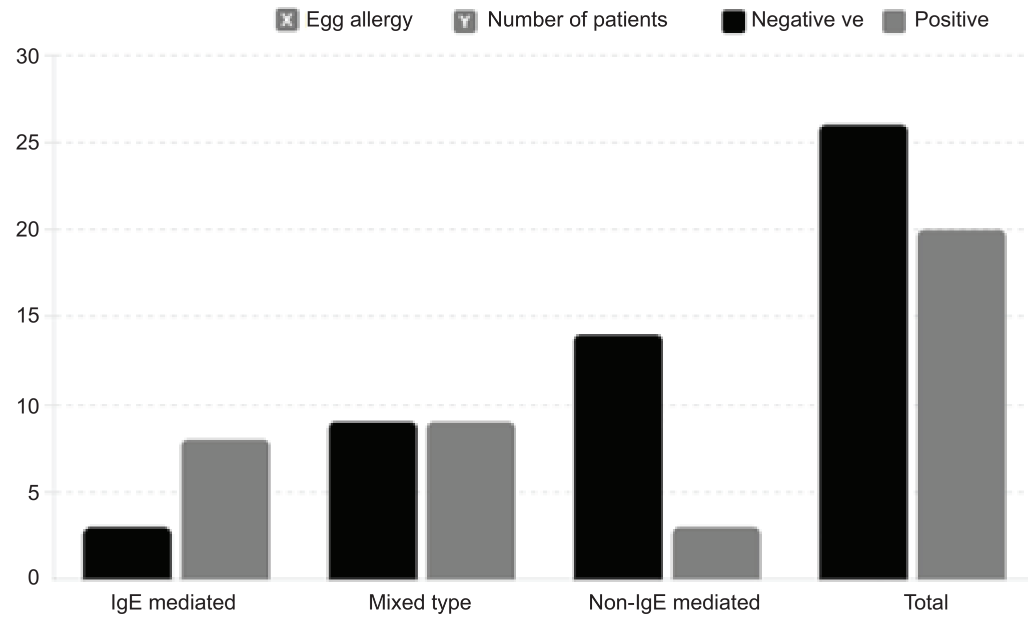

Figure 2 Positivity of the basophil activation test according to different types of egg allergy.

13.4 months, exceeding the protective effects mentioned in the literature; however, it does not provide a clear benefit in preventing specific food allergies.[16]

Children with egg allergy are more likely to have atopic comorbid conditions. These comorbidities include eczema (19%), asthma (46.5%), environmental allergies (38.2%), and eosinophilic esophagitis (1.2%). In our study, 79.5% of the patients were found to have atopic dermatitis, which is significantly higher compared to the literature.[1] Asthma is more common in children with egg allergy than in those with other top 8 food allergies. In our study, 8 patients (17.9%) were diagnosed with asthma. Children with intolerance to cooked eggs are more likely to be allergic to other foods, particularly milk. Of the children with egg allergy, 60.2% have additional food allergies, with milk (35.2%) and peanut (29.3%) being the most common.[1] In our study, six cases of egg allergy accompanied by milk allergy were identified.

Egg is reported to be a trigger in 7–12% of pediatric anaphylaxis cases. A recent study among infants found that egg was the most common food trigger for anaphylaxis, responsible for 38% of cases. While the severity of reactions to egg allergy can vary, it has been found that anaphylaxis triggered by eggs can be life-threatening in children with asthma.[17] In our study, four patients developed anaphylaxis due to accidental exposure.

In our study, patients with egg allergy were classified as IgE-mediated (20.75%), non-IgE-mediated (32.08%), and mixed type (47.17%). The literature indicates that IgE-mediated food allergies are the most common, and egg allergy frequently falls into this category.[18]

OFC is the gold standard for the accurate diagnosis of food allergies; however, it is a high-risk procedure for allergic reactions and is time- and resource-intensive. While SPT and sIgE have high sensitivity and negative predictive value (NPV), they have low specificity and positive predictive value (PPV), potentially leading to overdiagnosis. Even with negative SPT and/or sIgE results, an OFC may be necessary to clarify the diagnosis when the clinical history is consistent with an immediate IgE-mediated allergic reaction.[19] To improve diagnostic accuracy and reduce the number of patients needing OFC, new methods for testing food allergies, including component-resolved diagnostics and BAT, have emerged in recent years.[3] BAT demonstrates high sensitivity and specificity in IgE-mediated egg allergies. Several studies have shown that BAT outperforms serum-specific IgE (sIgE) tests and skin prick tests (SPT) in confirming egg allergy. Our study also demonstrated that BAT is a valuable test in diagnosing egg allergy in children, particularly for IgE-mediated and mixed-type allergies. BAT positivity was significantly higher in these allergy types compared to non-IgE-mediated allergies. This finding indicates that BAT has high sensitivity and specificity in detecting IgE-mediated allergies. In patients with IgE-mediated egg allergy, BAT showed a sensitivity of 93.1% and a specificity of 85.7%. The literature reports that BAT has a sensitivity of 63% and specificity of 96% for IgE-mediated egg allergies. In non-IgE-mediated allergies, BAT's sensitivity is lower, showing similar performance in mixed-type allergies.[20]

In our study, among the diagnostic tests, BAT exhibited the highest specificity and moderate sensitivity, making it more consistent with the oral provocation test in accurately diagnosing egg allergy.

Conclusion

Our study is the first to routinely use BAT (Basophil Activation Test) for egg allergy diagnosis in our country. It is important to note that BAT is a highly sensitive and specific test for diagnosing IgE-mediated and mixed-type allergies. This finding suggests that BAT should be more widely adopted in clinical practice. Currently, BAT is included in guidelines for diagnosing food allergies and is increasingly used in clinical applications.

In societies where milk and eggs play a significant role in the diet, such as in our country, food allergies pose serious health risks. Families may unknowingly or knowingly expose their children to suspected allergens, leading to potentially fatal outcomes such as anaphylaxis. Oral food challenges require additional time and cost for both patients and healthcare providers. Furthermore, some families may avoid coming to the hospital for the oral food challenge, opting to conduct it at home or maintaining a prolonged elimination diet out of fear.

Component-resolved diagnostics are costly in our healthcare system. Therefore, we believe that this study supports the more widespread use of the basophil activation test in clinical practice. The effectiveness of BAT, in terms of both sensitivity and specificity, offers a more reliable and cost-effective alternative for diagnosing food allergies, contributing to its broader adoption in clinical applications. The findings of our study represent an important step toward the widespread use and increased application of this test in clinical practice.

Authors Contribution

Ş.İ.K.K., F.Ö., R.S., A.Y: conceptualized and designed the study. Ş.İ.K.K: conducted data collection and analysis. AY: supervised the study and provided critical revisions. All authors contributed to the writing of the manuscript, interpreted the results, and gave final approval. All authors are responsible for the accuracy and integrity of the work.

Conflıct of Interest

The authors declare no potential conflicts of interest.

Fundıng

This study did not receive any funding.

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