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Adult IgE-mediated food allergy: clinical characteristics, predictors of severe reactions, and total IgE cut-off

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Abstract
Background: Adult immunoglobulin E (IgE)-mediated food allergy (FA) is increasingly recognized, yet it has remained under-characterized, compared with pediatric FA. We described clinical features, diagnostic profiles, predictors of severe reactions and explored a pragmatic total IgE cut-off in an adult cohort.
Method: We retrospectively reviewed 423 consecutive adults evaluated for suspected IgE-mediated FA at a tertiary center. Demographics, comorbid atopy, index culprit foods, diagnostic testing (skin prick/prick-to-prick, serum-specific IgE, component-resolved diagnostics), laboratory parameters, reaction severity (Brown grade severity), and adrenaline autoinjector (AAI) prescribing were extracted. Group comparisons used x^2/Fisher's exact, *t*-test, or Mann-Whitney U tests. Receiver operating characteristic analysis assessed the discriminative value of total IgE for confirmed FA. Variables associated with Brown grade 3 severity were examined by multivariable logistic regression.
Results: FA was confirmed in 79/423 patients (18.7%). Median age was 39.2 years; 71.4% were females. Frequent implicated groups were meat (23.9%), fruit (23.4%), nuts (22.5%), and vegetables (19.4%). Atopy was present in 46.1%; sensitization to mites and pollens occurred in 38.3% and 25.1%, respectively. Compared to non-confirmed cases, confirmed FA showed higher proportions of asthma, non-steroidal anti-inflammatory drug allergy, moderate/severe reactions (Brown grades 2–3 severity), atopy, mite/pollen sensitization, latex-fruit and pollen-fruit syndromes, AAI prescription, and food-dependent exercise-induced anaphylaxis (all $P < 0.05$). Eosinophil count/percentage and total IgE were also high (all $P < 0.05$). Total IgE ≥110.5 IU/mL predicted confirmed FA with 64.6% sensitivity and 59.7% specificity (area under curve 0.634; 95% confidence interval [CI]: 0.561–0.706; $P = 0.001$). In multivariable analysis, the absence of rhinitis and fish/seafood allergy, and the presence of atopy were independently associated with Brown grade 3 severity (model accuracy 84.4%). Overall, AAIs were prescribed in 38.1%, more often when FA was confirmed (66.7% vs 31.7%).

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Conclusions: Adult FA in a real-world tertiary cohort is clinically heterogeneous and clusters with respiratory atopy. A total IgE threshold of 110.5 IU/mL offers modest discrimination and should complement, not replace, history and allergen-specific testing. Rhinitis, fish/seafood allergy, and lack of atopy identify patients at higher risk of severe reactions and may guide risk stratification and AAI prescribing.

Introduction

Immunoglobulin E (IgE)-mediated food allergies are an important health problem that increasingly affects both children and adults, leading to impaired quality of life and, in some cases, life-threatening reactions.[1] Although food allergies have predominantly been investigated in children, persistence into adulthood or adult-onset cases have drawn growing attention to this age group.[2] In recent years, the prevalence of food allergies has risen; according to the US Food and Drug Administration (FDA) surveys, the reported proportion increased from 9.1% to 14.9%. In a large-scale study conducted in the United States, confirmed IgE-mediated food allergy was identified in 10.8% adults, with the most common allergens being shellfish, milk, peanuts, tree nuts, and fish.[3] In suspected cases of IgE-mediated food allergy, diagnosis relies not only on clinical history and physical examination but also on skin prick testing and measurement of allergen-specific IgE. As skin prick testing only indicates sensitization, results must be interpreted in the context of clinical history. Its high negative predictive value makes it especially useful for excluding allergy.[4] Component-resolved diagnostics, which measure sensitization to specific allergen proteins, may further improve diagnostic accuracy.[5] The double-blind, placebo-controlled food challenge remains the gold standard, although its risks and limited feasibility restrict routine use.[6] The cornerstone of management is strict avoidance of the culprit food. Patient education on label reading, emergency management, and the use of an adrenaline auto-injector (AAI) are crucial.[7] According to the European Academy of Allergy & Clinical Immunology (EAACI) 2024 guidelines, prescription of an AAI is recommended in patients with a history of anaphylaxis, uncontrolled asthma, or systemic mastocytosis.[7] Data on adult food allergy have been limited globally. Therefore, in this study, conducted at a national reference center, we aimed to evaluate the frequency of IgE-mediated food allergy in adults, identify the culprit foods, describe diagnostic methods and laboratory findings, and assess the proportion of AAI prescription.

Methods

Study design and population

This retrospective study included all food allergy patients who presented at a tertiary referral hospital between 2015 and 2024, covering a 10-year period. Adult patients with suspected or confirmed IgE-mediated food allergy were included. Confirmed "food allergy" was defined as a compatible clinical history together with one or more of the following diagnostic criteria: a positive skin prick test, defined as a wheal diameter of ≥3 mm than the negative control after 15 min; a positive prick-to-prick test, defined similarly as a wheal diameter ≥3 mm, compared to the negative control; serum-specific IgE levels >0.35 kU/L; or component-resolved diagnostics (CRD) indicating sensitization to clinically relevant allergen components with values >0.35 kU/L, and oral food challenge was performed in selected cases. Patients were evaluated in terms of their demographic characteristics (age, gender, and comorbidities), clinical features (allergic symptoms, severity, and comorbid atopic diseases), and laboratory findings (skin prick tests, specific IgE, eosinophil count, total IgE, and additional biomarkers).

Inclusion and exclusion criteria

Inclusion criteria: All patients aged ≥16 years who presented with suspected IgE-mediated food allergy, with available clinical, laboratory, and diagnostic test data.

Exclusion criteria: Patients aged <16 years; those with non-IgE-mediated food reactions; incomplete clinical or laboratory records; and those lost to follow-up at the first visit.

Statistical analysis

The data obtained from the study were entered into a computer and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive analyses were expressed as frequency (n) and percentage (%) for categorical variables, and as mean ± standard deviation (SD) or median (interquartile range) for continuous variables. Categorical variables were compared using the Pearson's chi-square test, Fisher's exact chi-square test, or Fisher–Freeman–Halton test, where appropriate. The normality of continuous data distribution was assessed using the Kolmogorov–Smirnov test. Parametric variables were analyzed with the ındependent samples *t*-test, and non-parametric variables were analyzed with the Mann–Whitney U test. Binary logistic regression analysis was performed to identify predictors of severe allergic reactions. Results were evaluated within a 95% confidence interval (95% CI), with a significance threshold of $P < 0.05$.

The study was approved by the Ethics Committee of the University of Health Sciences, Süreyyapaşa Chest Diseases and Thoracic Surgery Training and Research Hospital, Istanbul, Turkey.

Results

Demographics

A total of 423 patients who presented with suspected food allergy were included in the study. The mean age was 39.18 ± 13.06 years; nearly half of the cases (49.9%, n = 211) were aged 36–65 years. Female predominance was observed (71.4%, n = 302). Comorbid allergic diseases included rhinitis in 40.2%, asthma in 15.4%, eczema in 3.3%, chronic spontaneous urticaria (CSU) in 17.3%, and drug allergy in 19.1% of patients. These demographic and clinical characteristics are summarized in Table 1.

Table 1 Demographic and clinical characteristics of patients.

Variable	Results (N = 423)
Age (years), mean ± SD	39.18 ± 13.06
Age group (years), n (%)	
16–18	4 (0.8)
18–35	194 (46)
36–65	211 (49.9)
66–80	13 (3.1)
≥81	1 (0.2)
Gender (female), n (%)	302 (71.4)
Rhinitis, n (%)	170 (40.2)
Asthma, n (%)	65 (15.4)
Asthma phenotype (n = 65), n (%)	
Atopic eosinophilic	2 (3.1)
Non-atopic eosinophilic	1 (1.6)
Atopic non-eosinophilic	44 (68.8)
Non-atopic	17 (26.6)
Dermatitis, n (%)	14 (3.3)
Chronic spontaneous urticaria (CSU), n (%)	73 (17.3)
Mast cell activation syndrome, n (%)	2 (0.5)
Venom sting allergy (positive), n (%)	23/29 (79.3)
Drug allergy, n (%)	81 (19.1)
NSAID allergy	47 (11.1)
Antibiotic allergy	35 (8.3)
Other drug allergy	22 (5.2)
Other comorbidities, n (%)	
Autoimmune disease	28 (6.6)
Rheumatologic disease	15 (3.5)
Malignancy	5 (1.2)
Symptom onset after food intake (min), median (IQR)	15.00 (5.00–60.00)
Time from first symptom to diagnosis (months) median (IQR)	12.00 (2.00–24.00)

Clinical features

The median time to onset of symptoms after food ingestion was 15.0 min (interquartile range [IQR]: 5.0–60.0). The median interval between the first symptom and confirmed diagnosis of food allergy was 12.0 months (IQR: 2.0–24.0). Food allergy was confirmed in 79 patients (18.7%). The most frequently implicated food groups were meat (23.9%), fruits (23.4%), and vegetables (19.4%). Food allergy was primarily confirmed by positive specific IgE and prick-to-prick test results. Approximately 49.7% of the reactions were mild (Grade 1), 34.5% were moderate (Grade 2), and 15.8% were severe (Grade 3) (Table 2).

Laboratory findings

Atopy was present in 46.1% of patients, with sensitization to mites in 38.3% and to pollens in 25.1% (Table 3) The median eosinophil percentage was 1.70% (IQR: 0.90–3.45), and the median total IgE level was 91.0 IU/mL (IQR: 34.0–223.0). Detailed laboratory parameters are summarized in Table 4.

Comparison between confirmed and not confirmed food allergy cases

The distribution of clinical and laboratory variables between patients with confirmed and not confirmed food allergy is shown in Table 5. Asthma, nonsteroidal anti-inflammatory drug (NSAID) allergy, moderate-to-severe allergic reactions (Brown grades 2–3 severity), atopy, mite sensitization, pollen sensitization, latex-fruit syndrome, pollen-fruit syndrome, prescription of adrenaline autoinjector (AAI), and food-dependent exercise-induced anaphylaxis were significantly more common in patients with confirmed food allergy, compared to those without eaction to these allergens (P <0.05). Among laboratory parameters, eosinophil count, eosinophil percentage, and total IgE levels were also significantly higher in the confirmed group (P < 0.05).

Allergen-specific findings

The distribution of data according to culprit food types is summarized in Table 6.

Legumes: Patients with legume allergy had higher proportions of antibiotic allergy (20.7% vs 7.4%) and elevated immunoglobulin M (IgM) levels (P = 0.024; P = 0.001; P = 0.011, respectively).

Cereals: Lower frequency of drug allergy was observed (3.6% vs 20.3%, P = 0.030).

Table 2 Distribution of severity of allergy in patients.

Severity classification	Grade 1, n (%)	Grade 2, n (%)	Grade 3, n (%)
Brown classification	210 (49.7)	146 (34.5)	67 (15.8)

Note: N = 423.

Table 3 Index reactions and diagnostic confirmation in patients.

	Results (N = 423)
Index reaction	n (%)
Legumes	29 (6.9)
Cereals	28 (6.6)
Spices	16 (3.8)
Fruits	99 (23.4)
Vegetables	82 (19.4)
Tree nuts	95 (22.5)
Seeds	12 (2.8)
Milk	53 (12.5)
Egg	53 (12.5)
Fish and shellfish	45 (10.6)
Meat	101 (23.9)
Confirmed food allergy, n (%)	79 (18.7)
Diagnostic method (n = 79), n (%)	
Specific IgE	35 (44.3)
Prick-to-prick positive	35 (44.3)
Specific IgE + prick-to-prick positive	8 (10.1)
Prick-to-prick + oral food challenge positive	1 (1.3)
Oral food challenge performed, n (%)	5 (1.2)
Oral food challenge outcomes (n = 5), n (%)	
Negative	1 (20.0)
Shrimp/sea bass	1 (20.0)
Cooked chicken + lamb	1 (20.0)
Milk	1 (20.0)
Chicken meat	1 (20.0)
Component-resolved diagnostics (CRD), n (%)	45 (10.6)
Alpha-gal sensitization (to *α*-gal molecule) (n = 24), n (%)	12 (50.0)
Atopy, n (%)	195 (46.1)
Mite sensitization, n (%)	162 (38.3)
Pollen sensitization, n (%)	106 (25.1)

Table 4 Distribution of laboratory parameters.

	Results (N = 423)
Tryptase, median (IQR), ng/mL	4.80 (3.60–6.93)
Tryptase categories (n = 188), n (%)	131 (69.7)
<6 ng/mL	46 (24.5)
6–11.4 ng/mL	9 (4.8)
11.5–19.9 ng/mL	2 (1.1)
≥20 ng/mL	
Eosinophil count (10^3/μL), median (IQR)	120.00 (70.00–250.00)
Eosinophils (%), median (IQR)	1.70 (0.90–3.45)
ANA (n = 240), n (%)	
Positive	19 (7.9)
Negative	211 (87.9)
Weak positive	10 (4.2)
IgA (g/L), median (IQR)	1.70 (1.40–2.30)
IgA (n = 318), n (%)	
Normal	311 (97.8)
Deficient	5 (1.6)
High	2 (0.6)
IgG (g/L), median (IQR)	11.00 (10.00–12.60)
IgG (n = 319), n (%)	
Normal	315 (98.7)
Deficient	1 (0.3)
High	3 (0.9)
IgM (g/L), median (IQR)	1.20 (0.83–1.70)
IgM (n = 320), n (%)	
Normal	284 (88.8)
Deficient	7 (2.2)
High	29 (9.1)
Total IgE (IU/mL), median (IQR)	91.00 (34.00–223.00)
IgG4, median (IQR)	0.63 (0.22–0.93)
Anti-TPO (IU/mL), median (IQR)	9.00 (1.00–11.00)
Anti-TPO positivity (n = 221), n (%)	35 (15.8)
Latex–fruit syndrome, n (%)	9 (2.1)
Pollen–fruit syndrome, n (%)	11 (2.6)
Adrenaline autoinjector (AAI) prescribed, n (%)	161 (38.1)
Meat desensitization performed, n (%)	1 (0.2)
Eosinophilic esophagitis, n (%)	1 (0.2)
Food-dependent exercise-induced anaphylaxis, n (%)	7 (1.7)

Spices: More frequently associated with CSU (37.5% vs 16.5%, P = 0.041) and a higher proportion of moderate reactions (Brown grade 2 severity, P = 0.048).

Fruits: Higher proportions of asthma (24.2% vs 12.7%), antibiotic allergy (13.1% vs 6.8%), atopy (62.4% vs 46.6%), mite sensitization (52.7% vs 38.7%), pollen sensitization (39.8% vs 23.5%), latex-fruit syndrome (8.2% vs 0.3%), pollen–fruit syndrome (10.2% vs 0.3%), and AAI prescription (P < 0.05 for all).

Vegetables: More common in females (85.4% vs 68.0%), associated with higher CSU prevalence (25.6% vs 15.2%) and lower pollen sensitization proportion (18.2% vs 29.8%) (P < 0.05).

Tree nuts: More frequent atopy (60.9% vs 47.3%), mite sensitization (51.7% vs 39.1%), and pollen sensitization (44.8% vs 22.4%) (P < 0.05).

Seeds: Lower frequency in females (41.7% vs 72.3%) and higher proportions of moderate-to-severe reactions (Brown grades 2–3 severity, P = 0.021).

Milk: Lower proportions of pollen sensitization (12.2% vs 29.7%) and AAI prescription (24.5% vs 40.1%) (P < 0.05).

Eggs: More frequent drug allergy (32.1% vs 17.4%), autoimmune diseases (15.1% vs 5.4%), and elevated IgA levels (P < 0.05).

Fish and seafood: Prevalence varied across age groups, being higher in those aged <18 years (P = 0.006). In adults with fish/seafood allergy, rhinitis (55.6% vs 38.4%), NSAID allergy (20.0% vs 10.1%), autoimmune disease (15.6% vs 5.6%), and atopy (65.9% vs 48.6%) were more common (P < 0.05).

Meat: Lower prevalence of rhinitis (23.8% vs 45.3%), asthma (8.0% vs 17.4%), antibiotic allergy (2.0% vs 10.2%), mite sensitization (31.4% vs 45.0%), and pollen sensitization (14.9% vs 31.1%). Reaction latency was longer, while tryptase levels were lower (P < 0.05).

Table 5 Comparison of patients with and without confirmed food allergy.

	Confirmed FA (n = 79)	Not confirmed (n = 344)	P
Age, years (mean ± SD)	40.09 ± 12.35	38.98 ± 13.22	0.496[a]
Female, n (%)	51 (64.6)	251 (73.0)	0.136[b]
Rhinitis, n (%)	35 (44.3)	135 (39.2)	0.408[b]
Asthma, n (%)	19 (24.1)	46 (13.4)	0.018[b*]
Dermatitis, n (%)	2 (2.5)	12 (3.5)	1.000[c]
Chronic spontaneous urticaria (CSU), n (%)	16 (20.3)	57 (16.6)	0.435[b]
Drug allergy, n (%)	15 (19.0)	66 (19.2)	0.968[b]
NSAID allergy	14 (17.7)	33 (9.6)	0.038[b*]
Antibiotic allergy	5 (6.3)	30 (8.7)	0.486[b]
Autoimmune disease	7 (8.9)	21 (6.1)	0.374[b]
Rheumatologic disease	1 (1.3)	14 (4.1)	0.323[c]
Malignancy	1 (1.3)	4 (1.2)	1.000[c]
Symptom onset after food intake (minutes)	15.00 (5.00-56.25)	15.00 (5.00-60.00)	0.847[d]
Brown classification			
Grade 1	19 (24.1)	191 (55.5)	<0.001[b*]
Grade 2	36 (45.6)	110 (32.0)	
Grade 3	24 (30.4)	43 (12.5)	
Component-resolved diagnostics (CRD)	18 (23.1)	27 (7.9)	<0.001[b*]
Alpha-gal syndrome (n = 24)	6 (85.7)	6 (35.3)	0.069[c]
Atopy	49 (66.2)	146 (46.6)	0.002[b*]
Mite sensitization, n (%)	45 (60.8)	117 (37.5)	<0.001[b*]
Pollen sensitization, n (%)	32 (43.2)	74 (23.7)	0.001[b*]
Tryptase median (IQR):	5.30 (3.00-6.70)	4.60 (3.60-7.00)	0.887[d]
Eosinophil count (10^3/μL), median (IQR)	150.00 (90.00-302.50)	110.00 (60.00-240.00)	0.032[d*]
Eosinophils (%), median (IQR)	2.50 (1.10-4.40)	1.60 (0.90-3.30)	0.004[d*]
ANA (n = 240)			
Positive	4 (8.5)	15 (7.8)	0.231[c]
Negative	39 (83.0)	172 (89.1)	
Weak positive	4 (8.5)	6 (3.1)	
IgA (g/L), median (IQR)	1.90 (1.40-2.40)	1.70 (1.37-2.30)	0.604[d]
IgG (g/L), median (IQR)	11.00 (9.60-12.00)	11.10 (10.00-12.65)	0.139[d]
IgM (g/L), median (IQR)	1.18 (0.75-1.80)	1.20 (0.85-1.70)	0.684[d]
Total IgE (IU/mL), median (IQR)	153.00 (66.00-330.50)	82.50 (32.25-202.75)	0.001[d]
IgG4, median (IQR)	0.80 (0.21-0.86)	0.58 (0.21-0.86)	0.265[d]
Anti-TPO (IU/mL), median (IQR)	9.00 (1.00-16.00)	9.00 (1.00-11.00)	0.482[d]
Anti-TPO positivity (n = 221), n (%)	8 (16.7)	27 (15.6)	0.859[b]
Latex-fruit syndrome, n (%)	4 (5.1)	5 (1.5)	0.065[c]
Pollen-fruit syndrome, n (%)	6 (7.7)	5 (1.5)	0.007[c*]
AAI prescribed, n (%)	52 (66.7)	109 (31.7)	<0.001[b*]
Food-dependent exercise-induced anaphylaxis, n (%)	4 (5.1)	3 (0.9)	0.025[c*]

Notes: [a]Independent samples *t*-test; [b]Pearson's Chi-square test; [c]Fisher's exact test; [d]Mann-Whitney U test. *P < 0.05.

Diagnostic value of laboratory parameters

The receiver operating characteristic (ROC) curve analysis for total IgE showed that values ≥110.5 IU/mL predicted confirmed food allergy with 64.6% sensitivity and 59.7% specificity (area under curve [AUC] 0.634; 95% CI: 0.561-0.706; P = 0.001) (Figure 1).

Predictors of severe allergic reactions

Binary logistic regression analysis demonstrated that the absence of rhinitis and fish/seafood allergy, and the presence of atopy were significant predictors of severe (Brown grade 3 severity) reactions (Table 7).

Discussion

This study systematically evaluated the clinical and laboratory characteristics of 423 adult patients who presented with suspected food allergy. The confirmation proportion of 18.7% suggests that food allergy in adults has a non-negligible prevalence. The finding that meat, fruits, and vegetables were the most frequently implicated food groups indicates that adult food allergy is not limited to a few

Table 6 Comparative findings by food groups (selected groups shown).

	Legumes + (n = 29)	Legumes − (n = 394)	P	Fruits + (n = 99)	Fruits − (n = 324)	P	Meat + (n = 101)	Meat − (n = 322)	P
Age, years (mean ± SD)	43.52 ± 12.00	38.87 ± 13.09	0.064[a]			0.064[a]	38.50 ± 12.60	39.40 ± 13.21	0.550[a]
Female, n (%)	21 (72.4)	281 (71.3)	0.900[b]	77 (77.8)	225 (69.4)	0.108[b]	70 (69.3)	232 (72.0)	0.595[b]
Rhinitis, n (%)	12 (41.4)	158 (40.1)	0.892[b]	48 (48.5)	122 (37.7)	0.054[b]	24 (23.8)	146 (45.3)	<0.001 [b*]
Asthma, n (%)	4 (13.8)	61 (15.5)	1.000[c]	24 (24.2)	41 (12.7)	0.005[b*]	9 (8.9)	56 (17.4)	0.039[b*]
Dermatitis, n (%)	0	14 (3.6)	0.612[c]	4 (4.0)	10 (3.1)	0.748[c]	4 (4.0)	10 (3.1)	0.750[c]
Chronic spontaneous urticaria (CSU), n (%)	7 (24.1)	66 (16.8)	0.310[b]	20 (20.2)	53 (16.4)	0.376[b]	17 (16.8)	56 (17.4)	0.897[b]
Drug allergy, n (%)	9 (31.0)	72 (18.3)	0.092[b]	24 (24.2)	57 (17.6)	0.141[b]	16 (15.8)	65 (20.2)	0.333[b]
NSAID allergy	6 (20.7)	41 (10.4)	0.117[c]	14 (14.1)	33 (10.2)	0.273[b]	10 (9.9)	37 (11.5)	0.657[b]
Antibiotic allergy	6 (20.7)	29 (7.4)	0.024[c*]	13 (13.1)	22 (6.8)	0.045[b*]	2 (2.0)	33 (10.2)	0.008 [b*]
Autoimmune disease	2 (6.9)	26 (6.6)	1.000[c]	8 (8.1)	20 (6.2)	0.504[b]	7 (6.9)	21 (6.5)	0.885[b]
Rheumatologic disease	1 (3.4)	14 (3.6)	1.000[c]	2 (8.2)	13 (4.0)	0.537[c]	3 (3.0)	12 (3.7)	1.000[c]
Malignancy	1 (3.4)	4 (1.0)	0.300[c]	0	5 (1.5)	0.595[c]	0	5 (1.6)	0.597[c]
Symptom onset after food intake (min)	17.50 (3.25-97.50)	15.00 (5.00-60.00)	0.988[d]	10.00 (5.00-52.50)	15.00 (5.00-60.00)	0.988[d]	30.00 (5.00-120.00)	10.00 (5.00-30.00)	0.003[d*]
Brown classification									
Grade 1	9 (31.0)	201 (51.0)	0.070[b]	42 (42.4)	168 (51.9)	0.154[b]	52 (51.5)	158 (49.1)	0.612[b]
Grade 2	12 (41.4)	134 (34.0)		42 (42.4)	104 (32.1)		31 (30.7)	115 (35.7)	
Grade 3	8 (27.6)	59 (15.0)		15 (15.2)	52 (16.0)		18 (17.8)	49 (15.2)	
Atopy, n (%)	15 (53.6)	180 (50.1)	0.726[b]	58 (62.4)	137 (46.6)	0.008[b*]	36 (41.4)	159 (53.0)	0.056[b]
Mite sensitization, n (%)	14 (50.0)	148 (41.3)	0.371[b]	49 (42.7)	113 (38.6)	0.016[b*]	27 (31.4)	135 (45.0)	0.024[b*]
Pollen sensitization, n (%)	6 (21.4)	100 (27.9)	0.458[b]	37 (39.8)	69 (23.5)	0.002[b*]	13 (14.9)	93 (31.1)	0.003[b*]
Tryptase median (IQR)	5.12 (3.10-6.00)	4.80 (3.60-7.00)	0.614[d]	5.30 (4.00-7.00)	4.60 (3.50-6.90)	0.614[d]	4.20 (3.00-6.30)	5.02 (3.80-7.05)	0.035[d*]
Eosinophil count (10^3/µL), median (IQR)	115.00 (65.00-187.50)	120.00 (70.00-250.00)	0.704[d]	140.00 (82.50-265.00)	110.00 (60.00-245.00)	0.704[d]	120.00 (60.00-232.50)	110.00 (70.00-250.00)	0.761[d]
Eosinophils (%), median (IQR)	1.60 (1.00-3.02)	1.80 (0.90-3.50)	0.528[d]	2.20 (1.10-3.97)	1.70 (0.90-3.30)	0.528[d]	1.70 (0.80-3.30)	1.80 (1.00-3.50)	0.396[d]
IgA (g/L) median (IQR)	1.96 (1.30-2.40)	1.70 (1.40-2.30)	0.946[d]	1.80 (1.30-2.47)	1.70 (1.40-2.30)	0.946[d]	1.80 (1.37-2.45)	1.70 (1.40-2.27)	0.121[d]
IgG (g/L), median (IQR)	11.92 (10.50-12.45)	11.00 (9.97-12.60)	0.157[d]	11.00 (9.90-12.10)	11.20 (10.00-12.60)	0.157[d]	11.70 (10.00-13.10)	11.00 (10.00-12.50)	0.065[d]
IgM (g/L), median (IQR)	1.60 (1.13-1.91)	1.20 (0.80-1.60)	0.011[d*]	1.30 (0.92-1.60)	1.16 (0.80-1.80)	0.011[d*]	1.20 (0.84-1.55)	1.20 (0.81-1.70)	0.680[d]
Total IgE (IU/mL), median (IQR)	101.00 (20.00-219.00)	90.50 (34.00-228.50)	0.677[d]	88.50 (48.50-222.50)	91.00 (32.00-231.00)	0.677[d]	91.00 (35.50-203.00)	91.00 (33.00-237.00)	0.939[d]
IgG4 (g/L), median (IQR)	1.07 (0.22-1.5)	06.3 (0.22-0.89)	0.750[d]	0.54 (0.18-1.29)	0.63 (0.22-0.82)	0.750[d]	0.55 (0.20-0.90)	0.63 (0.22-1.08)	0.816[d]
Anti-TPO (IU/mL), median (IQR)	9.00 (1.00-9.75)	9.00 (1.00-12.00)	0.780[d]	9.00 (1.35-14.50)	9.00 (1.00-10.00)	0.780[d]	9.00 (1.00-12.25)	9.00 (1.00-11.75)	0.838[d]
Latex-fruit syndrome, n (%)	0	9 (2.3)	1.000[c]	8 (8.2)	1 (0.3)	<0.001[c*]	1 (1.0)	8 (2.5)	0.693[c]
Pollen-fruit syndrome, n (%)	0	11 (2.8)	1.000[c]	10 (10.2)	1 (0.3)	<0.001[c*]	0	11 (3.4)	0.074[c]
AAI prescribed, n (%)	14 (48.3)	147 (37.4)	0.245[b]	47 (48.0)	114 (35.2)	0.023[b*]	33 (32.7)	128 (39.9)	0.194[b]

Notes: [a]Independent samples *t*-test; [b]Pearson's Chi-square test; [c]Fisher's exact test; [d]Mann-Whitney U test. *P < 0.05.

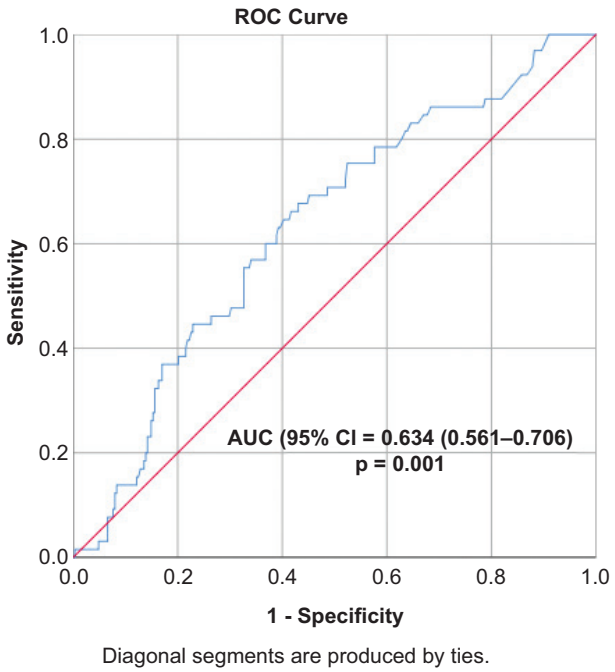

Figure 1 ROC curve for total IgE. Total IgE ≥ 110.5 IU/mL predicted confirmed food allergy with AUC 0.634 (95% CI: 0.561–0.706), sensitivity 64.6%, specificity 59.7% (P = 0.001). The optimal cut-off value of total IgE (110.5 IU/mL) was determined using the Youden index derived from the ROC curve.

Table 7 Multivariable logistic regression for severe reaction (Brown grade 3 severity).

	OR (95% CI)	P
Rhinitis (absent)	1.924 (1.009–3.667)	0.047
Fish/seafood allergy (absent)	4.359 (1.277–14.881)	0.019
Atopy (present)	2.323 (1.232–4.383)	0.009
Constant	0.183	<0.001

Notes: Cox & Snell R^2: 0.114; Nagelkerke R^2: 0.196; accuracy: 84.4%.

allergens typically associated with childhood. In addition, the higher proportions of asthma, atopy, and inhalant sensitizations observed in confirmed cases support the notion that adult food allergy frequently clusters with other atopic phenotypes. The observed increases in total IgE and eosinophil levels further underscore the potential value of biomarker-based risk stratification in the diagnostic process. Our findings highlight that management of adult food allergy should not rely solely on clinical history; instead, an integrated approach, including standardized skin tests, specific IgE measurements, and advanced diagnostic tools in selected cases, is warranted.

In a large-scale study conducted among individuals aged 18–60 years in Europe, the prevalence of food allergy varied considerably depending on the diagnostic method used: 3.5–19.6% based on self-reported history, 2–21.9% with positive specific IgE, 2.2% with symptoms combined with specific IgE positivity, and 0.1–3.2% confirmed by oral food challenge. In the same study, lifetime prevalence of food allergy was reported to range between 9.5% and 35%.[8] The confirmation proportions obtained in our study are consistent with the European data, further demonstrating that prevalence estimates can vary significantly depending on the diagnostic method employed.

Although studies on food allergy are common in children, data for the adult population remain quite limited.[9] A nationwide survey conducted in Japan demonstrated that despite the high number of adult food allergy patients, diagnostic and therapeutic services are largely based in pediatric centers. This highlights the insufficient healthcare infrastructure for adult food allergy and the significant gaps during the transition from childhood to adulthood.[10] Moreover, in the adult population, the relatively low awareness of food allergy suggests that a food-focused diagnostic approach is particularly useful to more accurately identify the causative allergens.[11] Considering this gap in the literature, our study is of particular value.

According to Skypala and colleagues,[12] the most important clinical condition in adult-onset food allergy is pollen–food syndrome, which develops as a consequence of pollen exposure. Contrary to common belief, wheat allergy is reported to be very rare.[12] In China, when allergen sensitization was analyzed over time and by age, milk and egg white were prominent in children, whereas in adulthood, wheat, sesame, peanut, and shellfish became more prevalent allergens.[13] A study conducted in India highlighted that local dietary sources play a more prominent role in the development of food allergy among adults.[14] In our patient series, meat and tree nuts were the leading perpetrators, followed by fruits. Understanding local dietary habits is therefore essential in management of adult food allergy to better identify the likely offender food groups.

In our cases, the median time between food intake and the onset of reaction was 15.0 min (IQR: 5.0–60.0). Studies from different geographical regions in adults have also reported that symptoms typically appear within the first 2 h.[15,16] In our cohort, the time interval between the onset of the first symptom and the diagnosis of food allergy was 12.0 months (IQR: 2.0–24.0). Although it has been emphasized that awareness of food allergy is lower in adults, data regarding diagnostic delays in this population are limited. Our study is therefore important as it highlights the presence of such diagnostic delays in adult food allergy.

In general, there is often poor concordance between the foods reported in the clinical history and those confirmed through diagnostic testing.[14] Therefore, the use of diagnostic tests, particularly confirmatory procedures, is strongly recommended. Skin prick testing, measurement of specific IgE, and food challenge tests are the main diagnostic tools. Considering the limited feasibility of the double-blind, placebo-controlled oral food challenge—the current gold standard—component-resolved diagnostics and, in selected cases, basophil activation testing can reduce false positives and improve specificity in adults.[9] In our patient cohort, these tests were also utilized to establish the diagnosis. Moreover, when fresh food was not available, skin prick testing using frozen fruit juices was

applied, which represents a valid and reliable diagnostic approach. In our ROC analysis, total IgE demonstrated only moderate sensitivity and specificity; however, diagnostic tools, such as skin prick testing, have a greater potential to enhance diagnostic accuracy. This underscores the importance of not relying solely on total IgE levels but rather integrating practical and validated skin testing methods into the diagnostic process.[17]

Although various tests can be used to confirm food allergy, the presence of cross-reactivity between allergens highlights the importance of access to component-resolved diagnostics (CRD) in both diagnostic process and allergen-avoidance strategies. Considering previous studies emphasizing cross-reactivity among different food groups, CRD testing should be performed whenever available.[18] In our patient cohort, CRD testing was also applied, and this was statistically significant, in particular among patients with confirmed allergies. Moreover, undergoing CRD testing was identified as a risk factor for severe allergic reactions. This finding may be explained by the fact that patients experiencing more severe reactions are more likely to undergo advanced diagnostic evaluations.[19]

The presence of rhinitis, seafood allergy, and the absence of atopy were identified as significant predictors of severe allergic reactions in our cohort. Supporting our findings, another study also demonstrated an association between rhinitis and severe reactions; however, in that study, asthma and peanut as the suspected allergen reached statistical significance.[20] Furthermore, asthma has been linked to fatal anaphylaxis.[21]

In patients with food allergy, preventive measures rather than treatment are generally associated with better outcomes.[22] Importantly, in cases of severe IgE-mediated food allergy, the first and most essential step is prescribing an AAI and providing appropriate patient education.[4] Accidental exposure to the allergenic food has been shown to be associated with both frequent and severe reactions, whereas proper identification of the allergen reduces the frequency of such events.[23] Previous studies have highlighted that when patients are correctly diagnosed and prescribed an AAI, they show improved adherence to allergen avoidance and follow-up care.[24] In our study, an AAI was prescribed to 38% of the overall cohort, with a statistically significant higher prescription proportion among those with confirmed food allergy.

In adults, multiple organ systems—including the respiratory, cardiovascular, cutaneous and mucosal, gastrointestinal, and neurological systems—may be affected, and reactions can present with varying degrees of severity.[16] Although our study did not evaluate individual systems separately, the observed differences in severity likely reflect the involvement of multiple systems.

In our study, a total IgE level of ≥110.5 IU/mL predicted the diagnosis of food allergy with 64.6% sensitivity and 59.7% specificity. Although this threshold does not provide high diagnostic accuracy on its own, it suggests that biomarker-based risk stratification could contribute to clinical decision-making in adults. Given the lack of consensus in the literature regarding reliable laboratory cut-off values for adult food allergy, our findings provide important real-world data. When interpreted together with clinical history and skin testing, the proposed cut-off may help to reduce false-negative and false-positive classifications, thereby strengthening the diagnostic approach. Nevertheless, this threshold requires confirmation in larger, multicenter, prospective studies.

In adults with IgE-mediated food allergy, elimination diets have been reported to increase not only the risk of malnutrition but also of overnutrition. This finding emphasizes that food allergies should be monitored not only from an immunological standpoint but also in terms of metabolic and nutritional health. In our cohort, the risk of nutritional deficiencies should be carefully considered, particularly among patients who eliminate essential food groups, such as fruits, vegetables, or milk. Monitoring for micronutrient deficiencies is clearly warranted in such patients.[25]

This study has several limitations. It was conducted in a single tertiary referral center with a retrospective design, which may introduce selection bias. Food allergy confirmation relied mainly on specific IgE and prick-to-prick testing, with only a small number of oral food challenges performed. This could lead to verification bias and an under- or overestimation of prevalence. Distinguishing between adult- and childhood-onset food allergy, as well as reliance on reported index reactions, also poses a risk of recall bias. Finally, nutritional status and system-specific symptom profiles were not evaluated using detailed, standardized scales, limiting causal interpretations.

Conclusion

Adult food allergy presents a more heterogeneous clinical picture than often expected; comorbid asthma and atopy, along with seafood sensitization and a history of rhinitis, are associated with an increased risk of severe reactions. Although the identified total IgE threshold of 110.5 IU/mL does not offer standalone diagnostic accuracy, it may serve as a practical reference point when combined with clinical history and skin testing. In our ROC analysis, this cut-off predicted food allergy with 64.6% sensitivity and 59.7% specificity (AUC 0.634; 95% CI: 0.561–0.706; P = 0.001). While not definitive, this finding contributes a real-world, hypothesis-generating reference to the literature, underscoring the need for multicenter prospective validation.

Author's Contribution

All authors contributed equally to this article.

Conflicts of Interests

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References

1. Sicherer SH, Warren CM, Dant C, Gupta RS, Nadeau KC. Food allergy from ınfancy through adulthood. J Allergy Clin Immunol Pract. 2020 Jun;8(6):1854–64. https://doi.org/10.1016/j.jaip.2020.02.010
2. Warren C, Nimmagadda SR, Gupta R, Levin M. The epidemiology of food allergy in adults. Ann Allergy Asthma Immunol. 2023 Mar;130(3):276–87. https://doi.org/10.1016/j.anai.2022.11.026
3. Gupta RS, Warren CM, Smith BM, Jiang J, Blumenstock JA, Davis MM, et al. Prevalence and severity of food allergies among US adults. JAMA Netw Open. 2019;2:e185630.
4. Anvari S, Miller J, Yeh CY, Davis CM. IgE-mediated food allergy. Clin Rev Allergy Immunol. 2019 Oct;57(2):244–60. https://doi.org/10.1007/s12016-018-8710-3
5. Sicherer SH, Sampson HA. Food allergy: A review and update on epidemiology, pathogenesis, diagnosis, prevention, and management. J Allergy Clin Immunol. 2018 Jan;141(1):41–58. https://doi.org/10.1016/j.jaci.2017.11.003
6. Jessen FB, Mortz CG, Eller E, Gudichsen JH, Baekdal EA, Bindslev-Jensen C. A comparison of double-blind, placebo-controlled food challenge and open food challenge. Allergy. 2023 Dec;78(12):3204–11. https://doi.org/10.1111/all
7. Santos AF, Riggioni C, Agache I, Akdis CA, Akdis M, Alvarez-Perea A, et al. EAACI guidelines on the management of IgE-mediated food allergy. Allergy. 2025; 80(1):14–36. https://doi.org/10.1111/all.16345
8. Nwaru BI, Hickstein L, Panesar SS, Muraro A, Werfel T, et al. The epidemiology of food allergy in Europe: A systematic review and meta-analysis. Allergy. 2014;69(1):62–75. https://doi.org/10.1111/ all.12305
9. Kuźniar J, Kozubek P, Gomułka K. Differences in the course, diagnosis, and treatment of food allergies depending on age-comparison of children and adults. Nutrients. 2024 Apr 27;16(9):1317. https://doi.org/10.3390/nu16091317
10. Sato S, Fukutomi Y, Sugizaki C, Suzuki S, Yagami A, Yanagida N, Ebisawa M. A Natıonwıde Survey On The Current Implementatıon Status Of Medıcal Practıces For Adult Patıents Wıth Food Allergıes In Japan. Arerugi. 2024;73(10):1200–09 (in Japanese). https://doi.org/10.15036/arerugi.73.1200
11. Grimshaw K, Denton SA, Hunter H, Reeves L, Skypala I, Williams M. A food-focused approach ıs needed to progress food allergy and hypersensitivity diagnosis and management in adults. Clin Exp Allergy. 2025 Jun;55(6):450–4. https://doi.org/10.1111/cea.70036
12. Skypala IJ, Mills CEN, Simpson A. Adult food allergy-public perception and reality. Clin Exp Allergy. 2025 Apr;55(4):291–3. https://doi.org/10.1111/cea.70044
13. Liu M, Liu L, Qi W, Zheng X, Chen J, Yao J, et al. Interpreting epidemiologic distribution of total and specific IgE levels for food allergy in Southern China from 2004 to 2023: Understanding the mechanisms and focusing on prevention. BMC Public Health. 2024 Oct 31;24(1):3022. https://doi.org/10.1186/s12889-024-20470-4
14. Dadha P, Nimmagadda S, Venter C, Gupta R, Kumar PU, Warren CM. Reported food-related symptoms and food allergen sensitization in a selected adult population in Hyderabad, India: A hospital-based survey. J Allergy Clin Immunol Glob. 2023 Dec 23;3(2):100204. https://doi.org/10.1016/j.jacig.2023.100204
15. Nicolaou SA, Pham ATA, Alexandrou A, Andreou E, Papanastasiou EC, Nicolaou N. Food allergy prevalence and characteristics among adults in Cyprus: Effects on health-related quality of life. Nutrients. 2025 Jun 18;17(12):2028. https://doi.org/10.3390/nu17122028
16. McIntyre A, Lee KE, Patel GB, Mathur SK, Singh AM. Food allergy symptoms in adults and children using the Food Allergy Research & Education Patient Registry. J Allergy Clin Immunol Pract. 2024 Jan;12(1):249–51.e1. https://doi.org/10.1016/j.jaip.2023.09.021
17. Terlouw S, van Boven FE, Borsboom-van Zonneveld M, de Graaf-In 't Veld T, Gerth van Wijk R, van Daele PLA, et al. Comparison of skin prick test and prick-to-prick test with fruits and vegetables in the diagnosis of food allergy. Clin Transl Allergy. 2024 Jul;14(7):e12375. https://doi.org/10.1002/clt2.12375
18. Alotiby A. Patterns and prevalence of food allergen cross-reactivity: A cross-sectional study of food-allergic adults in the Makkah region, Saudi Arabia. Cureus. 2025 Apr 24;17(4):e82942. https://doi.org/10.7759/cureus.82942
19. Bedolla-Pulido TR, Juárez-Luna DI, Morales-Romero J, Hernández-Colín DD, Núñez-Núñez ME, Bedolla-Barajas M. Prevalence and associated factors of hypersensitivity to tropical fruits among Mexican adults. Gac Med Mex. 2025;161(2):161–7. https://doi.org/10.24875/GMM.24000380
20. Pouessel G, Egea C, Divaret-Chauveau A, Beaumont P, Bradatan E, Dumond P, et al. Risk factors for fatal and near-fatal food anaphylaxis: Analysis of the allergy-vigilance network database. Clin Exp Allergy. 2025 Jul;55(7):532–40. https://doi.org/10.1111/cea.70089
21. Novembre E, Gelsomino M, Liotti L, Barni S, Mori F, Giovannini M, et al. Fatal food anaphylaxis in adults and children. Ital J Pediatr. 2024 Mar 5;50(1):40. https://doi.org/10.1186/s13052-024-01608-x
22. Krejner-Bienias A, Łyżwa K, Krupa-Łaska A, Zielińska J, Kulus M, Grzela K. Peanut allergy in children—Is prevention better than cure? Nutrients. 2024;16:3237. https://doi.org/10.3390/nu16193237
23. Svendsen SV, Senders AS, Oropeza AR, Lassen A, Bindslev-Jensen C, Mortz CG. Self-reported accidental allergic reactions among patients with challenge-verified food allergy. Clin Transl Allergy. 2025 Jun;15(6):e70067. https://doi.org/10.1002/clt2.70067
24. Dupuis R, Spergel JM, Brown-Whitehorn TF, Troxel AB, Kenney EL, Block JP, et al. Incidence of food allergic reactions among adolescents engaged in food allergy management. Ann Allergy Asthma Immunol. 2025 Jun;134(6):719–23.e2. https://doi.org/10.1016/j.anai.2025.02.023
25. Lazarević VV, Skypala IJ. Nutritional disorders prevalence among adults with immunoglobin E-mediated food allergy. Clin Exp Allergy. 2024 Nov;54(11):930–32. https://doi.org/10.1111/cea.14507