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ORIGINAL RESEARCH

A Clinical Profile of Ige-Mediated Food Allergies in Children: Experience from Bursa Uludag University

Şeyma ŞANLI[1], Gözde ÖZKAN[2], Şükrü ÇEKİÇ[2], Yakup CANITEZ[2], Nihat SAPAN[2]

[1] Dörtyol State Hospital, Hatay, Türkiye.
[2] Bursa Uludag University Faculty of Medicine Department of Pediatric Allergy, Bursa, Türkiye.

ABSTRACT

Food allergies are more prevalent in childhood and can result in life-threatening reactions. Although prevalence rates vary among populations, studies have shown that the global prevalence of food allergies ranges from 1% to 10%. The most common food allergens include milk, eggs, wheat, peanuts, tree nuts, fish, and shellfish. This study aimed to evaluate the allergen profile of children diagnosed with IgE-mediated food allergies who were admitted to the Pediatric Allergy Outpatient Clinic at Bursa Uludağ University Faculty of Medicine Hospital between June 2015 and June 2020. Among the patients, 63.6% were male, and the mean age at the time of presentation was 3.06 years. The majority (80.4%) presented with dermatological symptoms, and 10.2% experienced food-induced anaphylaxis. Atopy-related conditions were observed in 39.8% of the patients, with atopic dermatitis being the most common coexisting allergic disease frequently associated with IgE-mediated food allergies. Skin prick tests and serum-specific IgE analyses revealed that eggs and milk were the most prevalent allergens, respectively. Other commonly identified allergens included hazelnuts, peanuts, and walnuts. Management strategies involved a combination of dietary elimination and pharmacological treatment tailored to the individual patient's condition. This study underscores the importance of early identification of food allergies and the implementation of appropriate treatment strategies. Accurate diagnosis, avoidance of allergenic foods, and timely therapeutic interventions are essential for safeguarding patient health and preventing adverse allergic reactions.

Keywords: Food Allergy. Skin Eruptions. Anaphylaxis.

IgE Aracılı Besin Alerjili Çocuklarda Alerjen Profilinin Retrospektif Değerlendirilmesi

ÖZET

Besin alerjileri, genellikle çocukluk çağında daha sık görülür ve hayatı tehdit eden reaksiyonlara yol açabilir. Besin alerjisinin yaygınlığı toplumlar arasında farklılık göstermekle birlikte, yapılan çalışmalarda bu alerjilerin sıklığı %1 ile %10 arasında değişmektedir. Alerjik reaksiyonlara en sık neden olan besinler arasında süt, yumurta, buğday, yer fıstığı, kuruyemişler, balık ve deniz ürünleri bulunmaktadır. Bu çalışmada Bursa Uludağ Üniversitesi Tıp Fakültesi Hastanesi Çocuk Alerji Polikliniği'ne Haziran 2015-Haziran 2020 tarihleri arasında başvuran IgE aracılı besin alerjili çocuklarda alerjen profilinin değerlendirilmesi amaçlanmıştır. Hastaların %63,6'sı erkek, ortalama başvuru yaşı ise 3,06 yıl olarak bulunmuştur. Hastaların çoğu (%80,4) deri şikayetleri ile başvurmuştur. %10,2'sinde besinlere karşı anafilaksi gelişmiştir. Hastaların %39,8'inde atopi ile ilişkili hastalıklar mevcuttur. Atopik dermatit, en sık görülen eşlik eden alerjik hastalıktır ve IgE aracılı besin alerjileri ile sıklıkla ilişkilidir. Deri prik testi ve serum spesifik IgE test sonuçları, en sık alerjiye neden olan besinlerin sırasıyla yumurta ve süt olduğunu göstermektedir. Bunun dışında fındık, yer fıstığı, ceviz gibi diğer besin alerjenleri de sıklıkla tespit edilmiştir. Tedavi sürecinde, hastaların durumuna göre diyet ve ilaç tedavisi kombinasyonu kullanılarak alerjik reaksiyonların kontrol altına alınması hedeflenmiştir. Sonuç olarak, bu çalışma, besin alerjilerinin erken dönemde tanınmasının ve doğru tedavi yöntemlerinin uygulanmasının önemini vurgulamaktadır. Besin alerjilerinin doğru şekilde tanınması, alerjenlerin diyetten çıkarılması ve gerekli tedavi yöntemlerinin uygulanması, hem hastaların sağlığını korumak hem de alerjik reaksiyonların önüne geçmek için kritik rol oynamaktadır.

Anahtar Kelimeler: Besin Alerjisi. Cilt Döküntüsü. Anafilaksi.

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Dr. Gözde ÖZKAN
Uludağ Üniversitesi Tıp Fakültesi Çocuk Alerji Bilim Dalı, Bursa, Türkiye
E-mail: gozde_akay91@hotmail.com

AUTHORS' ORCID INFORMATION
Şeyma ŞANLI: 0009-0004-8827-992X
Gözde ÖZKAN: 0000-0002-8946-886X
Şükrü ÇEKİÇ: 0000-0002-9574-1842,
Yakup CANITEZ: 0000-0001-8929-679X
Nihat SAPAN: 0000-0002-7601-8392

Food allergies are adverse reactions to food that occur through immune-mediated mechanisms[1]. The prevalence of food allergies varies widely across populations. In survey-based studies relying on self-reported data, the estimated prevalence ranges from 3% to 35%, whereas studies utilizing diagnostic tests report confirmed food allergy rates between 1% and 10.8%[2]. The most common food allergens include milk, eggs, wheat, soy, peanuts, tree nuts, fish, and shellfish.

In a study conducted in Türkiye, 57.8% of children diagnosed with food allergies were found to be allergic to eggs, and 55.9% to cow's milk. These were followed by allergies to hazelnuts (21.9%), peanuts (11.7%), walnuts (7.6%), lentils (7%), wheat (5.7%), and red meat (5.7%) respectively[3].

Food allergies can be classified as IgE-mediated, non-IgE-mediated, or mixed-type, depending on the underlying immune mechanism. Cutaneous symptoms are the most frequently observed clinical manifestations of food allergies[4]. A thorough clinical history remains the cornerstone of diagnosis. Diagnosis is typically based on a detailed patient history supported by evidence of sensitization, such as positive skin prick tests and/or elevated specific IgE levels. In cases where the diagnosis remains uncertain, oral food challenges are often used to confirm allergy and assess tolerance[5]. The standard approach to managing food allergies involves strict avoidance of the offending allergen and the implementation of strategies to minimize the risk of accidental exposure[6].

This retrospective study aims to evaluate the clinical profiles of patients diagnosed with food allergies at our clinic and to investigate the prevalence and spectrum of food allergens in this population.

Material and Method

This retrospective study included a total of 470 patients who presented to the Pediatric Allergy Outpatient Clinic at Bursa Uludağ University Faculty of Medicine between 2015 and 2020 with complaints related to food intake and who had positive results on specific IgE testing and/or skin prick testing (SPT). Demographic and clinical data, along with laboratory test results, were retrieved from the hospital's electronic medical record system.

Skin prick tests were conducted in the Pediatric Allergy Laboratory of Bursa Uludağ University using standardized allergen extracts and disposable plastic lancets. Allergen droplets were applied to the volar surface of both forearms, maintaining a minimum distance of 2 cm between test sites. A separate lancet was used for each allergen, with a penetration depth of approximately 1 mm. Histamine (0.1%, 1 mg/mL) served as the positive control, while physiological saline was used as the negative control. Serum allergen-specific IgE levels were measured using the ImmunoCAP system (Phadia AB, Uppsala, Sweden).

A diagnosis of IgE-mediated food allergy was established based on the following criteria: (1) the onset of symptoms following the ingestion of a specific food, and (2) a wheal diameter on SPT at least 3 mm greater than the negative control and/or a specific IgE level ≥0.35 kU/L.

The study protocol was approved by the Clinical Research Ethics Committee of Bursa Uludağ University Faculty of Medicine (Decision No: 2020-11/11).

Statistical Analysis

Statistical analyses were conducted using NCSS (Number Cruncher Statistical System) 2020 software (Kaysville, Utah, USA). Descriptive statistics—including mean, standard deviation, median, frequency, percentage, minimum, and maximum values—were used to summarize the data. The normality of distribution for quantitative variables was assessed using the Shapiro-Wilk test and visual inspection of distribution plots.

The Mann-Whitney U test was employed to compare two independent groups for variables that did not follow a normal distribution. For comparisons involving more than two groups, the Kruskal-Wallis test was used, followed by the Dunn-Bonferroni post-hoc test to identify pairwise differences. A p-value of <0.05 was considered statistically significant.

Results

Between June 2015 and June 2020, a total of 666 patients presented to the outpatient clinic with suspected food allergies. Of these, 470 (70.7%) were diagnosed with food allergy, representing 3% of the 15,513 patients who presented to the Pediatric Allergy Outpatient Clinic with allergic complaints during this period. Among the diagnosed cases, 63.6% (n = 299) were male and 36.4% (n = 171) were female. The age at initial presentation ranged from 1 month to 17.6 years, with a mean age of 3.06 ± 3.12 years.

The most common presenting symptom was cutaneous involvement, observed in 80.4% (n = 378) of patients. Food-induced was reported in 10.2% (n = 48) of the cases. Among patients who experienced anaphylaxis due to foods, 43.8% (n=21) reacted to milk and dairy products, 10.4% to infant formula, 18.8% (n=9) to hazelnuts, and 12.5% (n=6) to eggs. Other presenting symptoms and their respective frequencies are listed in Table I.

A concomitant allergic disease was identified in 39.8% (n = 187) of the patients. Atopic dermatitis was the most frequently observed comorbidity, present in 58.8% (n = 110) of those with multiple allergic conditions. Detailed data on coexisting allergic diseases are presented in Table I.

A family history of allergic conditions was reported in 19.6% (n = 92) of the cases, while a specific family history of food allergy was present in 5.3% (n = 25). The most commonly reported familial allergic disease was allergic rhinitis, occurring in 45.6% of those with a positive family history.

Regarding treatment strategies, 98.9% (n = 464) of patients were managed with an elimination diet. Oral antihistamines were prescribed to 55.9% (n = 262), while maternal elimination diet was recommended in 40.2% (n = 191) of cases, particularly in breastfeeding infants. Epinephrine autoinjectors were prescribed to 11.5% (n = 54) of patients due to a history of confirmed or suspected anaphylaxis, and 9.4% (n = 44) had used the medication.

Demographic characteristics, clinical features, and treatment modalities are summarized in Table I.

Table I. Basic Characteristics and Treatment Approaches

	n (%)
Sex (Female)	171 (36.4)
Distribution of Presenting Complaints	
Cutaneous symptoms	378 (80.4)
Gastrointestinal symptoms	116 (24.7)
Respiratory symptoms	84 (17.9)
Oral allergy symptoms	33 (7.02)
Allergic conjunctivitis	6 (1.28)
Perianal dermatitis	5 (1.06)
Syncope	1 (0.21)
Patients with any allergic disease n (%)	
Atopic dermatitis	110 (58.8)
Allergic rhinitis	52 (27.8)
Allergic asthma	44 (23.5)
Drug allergy	9 (4.8)
Allergic conjunctivitis	4 (2.1)
Angioedema	3 (1.6)
Eosinophilic esophagitis	2 (1.06)
Distribution of Family History of Allergic Diseases	
Allergic rhinitis	42 (45.6)
Asthma	11 (12.1)
Atopic dermatitis	9 (9.8)
Drug allergy	9 (9.8)
Chronic urticaria	3 (3.3)
Contact dermatitis	1 (1.1)
Treatment Modalities	
No treatment	1 (0.2)
Any treatment	469 (99.8)
Elimination diet	464 (98.9)
Oral antihistamines	262 (55.9)
Maternal elimination diet	191 (40.2)
Epinephrine prescribed	54 (11.5)
Epinephrine administered	44 (9.4)

According to the skin prick test results of the patients included in the study, the most frequently observed food allergen was egg white, found in 30.4% of cases (n=143). Based on serum-specific IgE results, the most common food allergen was milk, which was detected in 53% of the patients (n=249). Other allergenic foods and their frequencies are listed in Table II.

Laboratory investigations revealed eosinophilia in 46.8% of the patients (n=220). The mean total IgE level was 487.9 ± 91.8 kIU/L, and 66.4% of patients (n=312) had total IgE levels above the reference range.

Table II. Skin and Laboratory Test Results

	n (%)
Distribution of Skin Prick Test Allergen Positivity	
Egg white	143 (30.4)
Egg yolk	52 (11.1)
Cow's milk	130 (27.7)
Hazelnut	29 (6.2)
Peanut	26 (4.5)
Tomato	7 (1.5)
Fish	4 (0.8)
Wheat	3 (0.6)
Peach	4 (0.6)
Distribution of Specific IgE Results	249 (53)
Cow's milk	17 (3.6)
Casein	14 (3)
Beta-lactoglobulin	4 (0.8)
Alpha-lactalbumin	214(45.5)
Egg white	13 (2.8)
Egg yolk	22 (4.7)
Hazelnut	20(4.3)
Peanut	14 (3)
Walnut	9 (1.9)
Wheat	4 (0.8)
Beef	4 (0.8)
Potato	4(0.8)
Tomato	3 (0.6)
Peach	
Laboratory Parameters	mean ± SD
Eosinophil count (×10⁹/L)	0.54 ± 0.52
Total IgE (kIU/L)	487.9 ± 91.80

When skin prick test results and specific IgE levels for suspected allergens were evaluated together, it was found that among patients who presented with anaphylaxis, 4 cases (8.3%) had a positive specific IgE result despite a negative skin test. In comparison, 6 cases (12.5%) had a negative specific IgE result but a positive skin test. Overall, most patients (n=338, 79.1%) tested positively for both. The rate of dual test positivity was significantly higher than the positivity rate in either test alone ($p<0.001$).

Discussion and Conclusion

The prevalence of food allergies reported by patients or caregivers is typically overestimated, with self-reported food allergy prevalence (12–16%) is typically 4–5 times higher than objectively confirmed rates (3–8%)[7]. In our study, the prevalence of food allergy confirmed by skin prick testing (SPT) and/or serum-specific IgE measurement was 3%, aligning with findings reported in the literature.

Previous studies have shown that food allergies are more commonly observed in males[8]. Our findings are

consistent with this trend: 63.6% (n = 299) of the diagnosed patients were male, while 36.4% (n = 171) were female.

IgE-mediated food allergy is the most common form of food hypersensitivity, affecting 0.4–10% of the general population[9]. Recent international studies estimate this rate to be approximately 3.5% to 4%, whereas a regional study from Turkey's Black Sea region reported a considerably lower prevalence of 0.8%[10,11]. In our cohort, the prevalence of IgE-mediated food allergy was 3% (n = 470), consistent with reported interregional variability.

Food allergens vary according to age, ethnicity, and dietary habits. While cow's milk and eggs are the most common allergens in childhood, other foods such as peanuts, fish, shellfish, soy, and wheat are also known to trigger allergic reactions in this age group. Allergen prevalence varies with genetics and diet. In the U.S., cow's milk and eggs are most frequent, whereas in Turkish cohorts, eggs and milk similarly predominate[12,3]. Consistent with these findings, in our study, the most prevalent allergens identified via skin prick testing were egg white (30.4%, n = 143) and egg yolk (11.1%, n = 52). Cow's milk was the second most common allergen (27.7%, n = 130), followed by hazelnut (6.2%, n = 29), peanut (5.5%, n = 26). Similarly, in a Turkish study on IgE-mediated food allergy, the predominant allergens were egg white (81.5%), cow's milk (68.7%), and hazelnut (28%)[13]. Our findings from specific IgE testing also aligned with these results, showing milk (53%, n = 249) and egg white (45.5%, n = 214) as the most common allergens, with egg yolk (2.8%, n = 13), hazelnut (4.7%, n = 22), peanut (4.3%, n = 20), and walnut (3%, n = 14) following.

In AbdulAal et al.'s study, cutaneous symptoms (88.7%) predominated, followed by gastrointestinal (65.7%) and respiratory (46.5%) manifestations[14]. Likewise, a Chinese study of 352 patients under 14 years reported urticaria and/or angioedema in 36.1%, eczema in 22.4%, gastrointestinal symptoms in 20.8%, and respiratory symptoms in 8.6%[15]. Our study found a similar pattern, with cutaneous symptoms being the most common (80.4%), followed by gastrointestinal (24.7%) and respiratory symptoms (17.9%).

In children, food allergens are the leading cause of anaphylaxis, mainly related to IgE-mediated mechanisms. In the United States, food-induced anaphylaxis rates have been reported to range from 13% to 65% depending on the region[16]. In our cohort, 10.2% of patients experienced food-induced anaphylaxis. In Thailand, the most frequent anaphylaxis-inducing foods were shellfish (37%), wheat (15.1%), and milk (11%)[17]. Another study reported that milk (59%), egg (20%), wheat (7%), and peanut (3%) were the most common causes of anaphylaxis in infants, while peanut (27%) and cashew (23%) were more prominent in preschool children[18]. Consistent with this, in our study, milk and dairy products (43.8%), hazelnut (18.8%), eggs (12.5%), and peanut (10.4%) were the most frequent anaphylaxis triggers. Variability in anaphylaxis incidence and causative allergens may be explained by geographic differences and inconsistencies in reporting.

Previous research has demonstrated that food allergy in children with atopic dermatitis—particularly in younger age groups—is associated with more severe disease and an increased risk of developing respiratory allergic diseases[19,20]. In studies from the United States, atopic dermatitis was present in 35–71%, allergic asthma in 34–49%, and allergic rhinitis in 33–40% of patients with food allergy[21,22]. Our study found similar comorbidities, with atopic dermatitis (23.4%, n = 110), allergic rhinitis (11%, n = 52), and allergic asthma (9.4%, n = 44) being the most common.

Regarding treatment, a European study indicated that 75.7% of food-allergic patients required treatment, with 86.7% adhering to elimination diets and most receiving medical therapy [23]. In our cohort, nearly all patients (99.8%) received treatment either prior to or during their clinic visit. The most commonly employed treatment modalities included elimination diets (98.9%), oral antihistamines (55.9%), and maternal elimination diet (40.2%), which aligns with the literature.

In conclusion, although IgE-mediated food allergy represents a significant public health concern due to its potential to cause life-threatening reactions, allergen avoidance remains the cornerstone of treatment. This study provides clinical and laboratory data that aid accurate diagnosis, guide patient management, and help reduce morbidity from IgE-mediated food allergy.

Limitations

The gold standard for the diagnosis of food allergy, the double-blind placebo-controlled food challenge (DBPCFC), was performed in only a few patients and was therefore not included as a diagnostic criterion. As a result, the precise prevalence and allergen profile of confirmed IgE-mediated food allergy could not be determined. Additionally, since the data were obtained solely from the hospital's electronic medical records, important variables such as the age of symptom onset and age at diagnosis could not be assessed due to the absence of detailed patient history in many cases.

Researcher Contribution Statement:
Idea and Design: Ş.Ş., N.S.; Data Collection and Processing: Ş.Ç., Y.C., N.S., Ş.Ş.G.Ö.; Analysis and Interpretation of Data: Ş.Ş., N.S.; Writing of Significant Parts of the Article: Ş.Ş., G.Ö.

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