Original Article
DOI: 10.4274/jbuch.galenos.2025.15689

Allergen Sensitization Profiles and the Diagnostic Value of Total IgE, Eosinophil and Basophil Levels in Predicting Atopy in Allergic Diseases in Children

Çocuklarda Alerjik Hastalıklarda Atopiyi Öngörmede Total IgE, Eozinofil ve Bazofil Düzeylerinin Tanısal Değeri ile Alerjen Duyarlanma Profilleri

Çağla Özbakır[1], İdil Akay Hacı[2], Mehmet Şirin Kaya[2], Canan Şule Karkıner [2], Özlem Sancaklı[2], Demet Can[2], Nesrin Gülez[2]

[1]University of Health Sciences Dr. Behcet Uz Children's Hospital, Department of Pediatrics, İzmir, Turkey
[2]University of Health Sciences Dr. Behcet Uz Children's Hospital, Department of Pediatric Immunology and Allergy İzmir, Turkey

Çağla Özbakır, University of Health Sciences Dr. Behcet Uz Children's Hospital, Department of Pediatrics, İzmir, Turkey
caglaaydogmus@gmail.com

Cite as: Özbakır Ç, Akay Hacı İ, Kaya MŞ, Karkıner CŞ, Sancaklı Ö, Can D, Gülez N. Allergen sensitization profiles and the diagnostic value of total ıge, eosinophil and basophil levels in predicting atopy in allergic diseases in children.

09.05.2025
01.09.2025

Epub: 07.11.2025

Abstract
Objective: Allergy is a hypersensitivity reaction triggered by various factors through immunological mechanisms. Elevated serum total IgE and peripheral blood eosinophil levels are commonly observed in allergic diseases; however, these biomarkers are not specific to allergy. This study aimed to evaluate the diagnostic value of serum total IgE, eosinophil, and basophil levels in predicting atopy.
Method: Atopic and non-atopic patients under 18 years of age diagnosed with atopic dermatitis, food allergy, allergic rhinitis, or asthma.were compared in terms of serum total IgE levels, eosinophil, and basophil counts.
Results: A total of 673 patients including 406 (60.3%) atopic and 267 (39.7%) non-atopic cases constituted the study population. Most frequently sensitization developed to egg in atopic dermatitis, and food allergy, to tree pollens in allergic rhinitis, and to house dust mite in asthma. Elevated total IgE levels were significantly associated with atopy in patients with allergic rhinitis and asthma, with odds ratios of 3.33 and 16.37, respectively ($p<0.001$). The optimal predictive cut-off value of serum total IgE for atopic asthma was calculated as 108.5 kU/L, with a sensitivity of 85.6% and specificity of 76.6%. Similarly, a significant association was observed between eosinophilia and atopy in allergic rhinitis and asthma, but not in atopic dermatitis.
Conclusions: Our findings suggest that serum total IgE is a sensitive and specific biomarker for predicting atopy in patients with asthma.
Keywords: allergic diseases, atopy, children, eosinophil, total IgE

Öz
Amaç: Alerji, çeşitli faktörlerle tetiklenen immünolojik mekanizmalar yoluyla ortaya çıkan bir aşırı duyarlılık reaksiyonudur. Serum total IgE ile kan eozinofil düzeylerinin alerjik hastalıklarda artmış olması yaygın bir durumdur; ancak bu artış, yalnızca alerjiye özgü değildir. Bu çalışmada, serum total IgE, eozinofil ve bazofil düzeylerinin atopiyi belirlemedeki tanısal değeri araştırılmıştır.

Yöntem: Atopik dermatit, besin alerjisi, alerjik rinit veya astım tanısı almış 18 yaş altı hastalardan veri toplanmıştır. Atopik ve non-atopik hastalar; serum total IgE düzeyleri, kan eozinofil sayıları ve bazofil sayıları açısından karşılaştırılmıştır.
Bulgular: Çalışmaya toplam 673 hasta dahil edilmiş olup bunların 406'sı (%60,3) atopik, 267'si (%39,7) ise non-atopiktir. Atopik dermatit ve besin alerjisinde en sık duyarlanma yumurtaya; alerjik rinitte, ağaç polenine; astımda ise ev tozu akarına karşı saptanmıştır. Alerjik rinit ve astım hastalarında total IgE yüksekliği, atopiyi öngörmede sırasıyla 3,33 ve 16,37 kat artmış risk ile anlamlı şekilde ilişkili bulunmuştur ($p<0,001$). Atopik astım hastalığını öngören serum total IgE için kestirim değeri 108,5 kU/L olarak hesaplanmış olup, duyarlılığı %85,6 ve özgüllüğü %76,6'dır. Benzer şekilde, alerjik rinit ve astımda eozinofili varlığı ile atopi arasında anlamlı bir ilişki saptanırken, atopik dermatitte bu ilişki gösterilememiştir.
Sonuç: Verilerimiz, serum total IgE düzeylerinin; duyarlılık ve özgüllük oranları dikkate alındığında, astımda atopinin varlığını öngörmede faydalı bir parametre olduğunu göstermektedir.
Anahtar Kelimeler: alerjik hastalıklar, atopi, çocuklar, eozinofil, total IgE

INTRODUCTION

Allergy is a hypersensitivity reaction that develops through immunological mechanisms induced by various triggers. Atopic dermatitis, food allergy, allergic rhinitis, and asthma constitute the allergic march. [1] Recently, an increase in the prevalence of allergic diseases has been observed worldwide. [2,3]

Although elevated total serum IgE levels and increased eosinophil counts in blood are frequently seen in allergic diseases, this increase is not specific to allergic conditions alone. High serum IgE levels can also be encountered in a variety of clinical entities such as parasitic infestations, infections, malignancies, and immunodeficiencies.[4] On the other hand, some allergic diseases may present without elevated eosinophil or IgE levels. Unlike the Basophil Activation Test, which is highly sensitive in detecting atopic allergy, the clinical significance of absolute peripheral basophil count (APBC) remains unclear.[5] Therefore, studies continue to search for more definitive clues and specific diagnostic methods helpful in the diagnosis and monitoring of allergic diseases.

The objectives of this study are to determine whether serum total IgE, eosinophil, and basophil levels are elevated in patients with allergic diseases followed in a tertiary care hospital in Turkey, and also to investigate whether these laboratory parameters have diagnostic value in identifying atopy. In addition, as a secondary objective, the distribution of common allergen sensitization patterns among different allergic disease groups will also be analyzed to provide contextual information for interpreting these laboratory findings.

MATERIALS and METHODS

This retrospective, single-center, cross-sectional study was conducted at a tertiary care hospital that serves as a referral center for pediatric patients. Patients under the age of 18 with allergic symptoms who had been clinically diagnosed with atopic dermatitis, food allergy, allergic rhinitis, or asthma between January 2018 and January 2021 were included in the study if they had undergone both skin prick and allergen-specific IgE tests. The diagnoses were established according to the following guidelines: Hanifin and Rajka criteria for atopic dermatitis, European Academy of Allergy and Clinical Immunology (EAACI) guidelines for food allergy, Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines for alleric rhinitis and the Global Initiative For Asthma (GINA) guidelines for asthma[6–9].

The medical records of the patients were reviewed retrospectively after obtaining approval from the XXX Local Research Ethics Committee (ethical decision no: 2021/17-02 date: November 04, 2021). Patients with known chronic diseases (such as immunodeficiency), parasitic infections, or chronic drug users, as well as those with missing either complete blood count or serum total IgE test results, were excluded from the study to minimize factors that could affect total IgE, eosinophil, or basophil levels. Data including age, sex, allergic disease diagnosis, serum total IgE levels, eosinophil and basophil counts/percentages, skin prick test, and allergen-specific IgE test results were recorded in case report forms.

In the study, ALK-Abello prick test solutions were used for the skin prick tests. Inhalant allergens included house dust mites, mold, grass pollens, tree pollens, cat dander, dog dander, and cockroach. Food allergens included egg white, egg yolk, cow's milk, wheat flour, peanut, and soy flour. An induration of ≥ 3 mm compared to the negative control was considered a positive result.

The specific IgE test was performed using the IMMULITE® 1000 immunoassay analyzer and the ELISA method, with values of 0.35 kU/L or higher considered positive. Specific IgE testing for egg, milk, grass pollens, and house dust mite was performed individually. In addition, standardized allergen panels were used. The inhalant panel consisted of *Dermatophagoides pteronyssinus*, cat dander, dog dander, horse dander, cockroach, and *Cladosporium herbarum,* , while egg, milk, codfish, wheat, peanut, and soybean included in the food panel . The serum total IgE test was also conducted using the IMMULITE® immunoassay analyzer and the ELISA method, and values of 100 kU/L or higher were defined as elevated IgE levels. Eosinophil and basophil counts were determined using the Sysmex XN-1000™ Automated Hematology Analyzer and the flow cytometry method. Eosinophilia was defined as an eosinophil count greater than 450/mm³ or its percentage above 4%, while basophilia was defined as a basophil count greater than 100/mm³ or a percentage above 1%.

The patients with allergic symptoms and a clinical diagnosis of allergic diseases (atopic dermatitis, food allergy, allergic rhinitis, or asthma) were classified into two groups: the atopic group (case group), with at least one positive skin prick test or allergen-specific IgE test result, and the non-atopic group (control group), with negative results in both tests despite the presence of allergic symptoms.

Statistical Analysis

Statistical analyses were performed using SPSS version 25.0 (SPSS Inc., Chicago, IL, USA). All numerical and categorical data were evaluated using descriptive statistical methods. Non-parametric continuous numerical variables were described using the median and interquartile range (IQR), while categorical variables were presented as numbers and percentages.

A multivariate logistic regression analysis was conducted to evaluate the relationship between atopy and peripheral blood parameters (elevated serum total IgE levels , eosinophilia, and basophilia) in different allergic diseases. Results were reported as odds ratios (OR), 95% confidence intervals (CIs), and p-values. Receiver Operating Characteristic (ROC) analysis and the Youden index were used to determine the cut-off values of serum total IgE levels, eosinophil counts, and percentages that best predicted atopic disease. Results with a p-value <0.05 were considered statistically significant.

RESULTS

A total of 673 participants including 423 (62.9%) male and 250 (37.1%) female patients were included in the study.. The patients received the diagnosis of asthma (n=299;44.4%), allergic rhinitis. (n=206; 30.6%), atopic dermatitis (n=89; 13.2%), and food allergy (n=79; 11.7%). The median age of the patients was 60 months (IQR: 36–96). A majority of patients with atopic dermatitis (80.9%, n=72) and food allergy (78.5%, n=62) were aged 12 months or younger. Atopy was detected in 60.3% (n=406) of the patients. Table 1 presents the demographic and clinical characteristics of the patients.

According to serum-specific IgE test results, the rates of sensitization to any allergen were 80.9% (n=72) in atopic dermatitis, 94.9% (n=75) in food allergy, 53.4% (n=110) in allergic rhinitis, and 30.1% (n=90) in asthma. Based on skin prick test results, the rates of sensitization to any allergen were 62.9% (n=56) in atopic dermatitis, 86.1% (n=68) in food allergy, 63.6% (n=131) in allergic rhinitis, and 33.1% (n=99) in asthma. When both tests were evaluated together, the overall rates of atopy were 85.4% (n=76) in atopic dermatitis, 100% (n=79) in food allergy, 68.0% (n=140) in allergic rhinitis, and 37.1% (n=111) in asthma.

According to serum-specific IgE test results, the most common sensitizing allergen in patients with atopic dermatitis and food allergy was egg, with sensitization rates of 75.3% and 74.7%, respectively. In patients with allergic rhinitis and asthma, the most common sensitization was to grass pollens, with sensitization rates of 30.1% and 9.4%, respectively. Table 2 shows the specific IgE test results of the patients.

According to the skin prick test results, food allergens were the most frequently identified sensitizers in patients with atopic dermatitis (62.9%) and food allergy (84.8%). The most common food allergen was egg with indicated senstization rates in atopic dermatitis (58.4%) and in food allergy, (64.6%) followed by milk (20.2% vs 39.2%,) and cereals (16.9% vs 8.9%,).

Sensitizations to tree nuts, legumes, and seeds were less frequent. Sensitization to multiple food allergens was observed in 31.6% of the patients with food allergy. In patients with allergic rhinitis

the most common sensitization was to tree.pollens (32.0%), while in patients with asthma, it was to house dust mites (18.1%). Table 3 presents the skin prick test results.

Elevated serum total IgE levels was detected in 47.8% (n=143), eosinophilia in 47.2% (n=141), and basophilia in 5.4% (n=16) of the patients of the patients diagnosed with asthma. In patients with asthma, a significant association was found between elevated serum total IgE levels and atopy (OR: 16.37; 95% CI: 8.531–31.412; p<0.001). The presence of eosinophilia was also significantly associated with atopy (OR: 1.99; 95% CI: 1.086–3.631; p=0.026). However, no significant relationship was observed between the presence of basophilia and atopy in patients with asthma (OR: 3.15; 95% CI: 0.754–13.121; p=0.116).

Relatively higher serum total IgE levels were observed in 60.7% (n=125), eosinophilia in 50.5% (n=104), and basophilia in 6.8% (n=14) of the patients diagnosed with allergic rhinitis Among patients with allergic rhinitis, atopy was significantly associated with elevated serum total IgE levels (OR: 3.33; 95% CI: 1.737–6.379; p<0.001) and eosinophilia (OR: 2.81; 95% CI: 1.441–5.493; p=0.002). There was no statistically significant association between basophilia and atopy (OR: 5.02; 95% CI: 0.626–40.218; p=0.129).

Age-stratified analysis revealed differences in serum total IgE levels of the patients with atopic dermatitis.. Relatively higher serum total IgE levels were observed in 23.6% of those aged ≤12 months and 41.2% of those older than 12 months. Overall, 27.0% (n=24) of patients presented with elevated serum total IgE values, while indicated number (%) of patients had eosinophilia (n=66;74.2%) or basophilia (n=3; 3.4%). In patients with atopic dermatitis, any significant correlations were not found between atopy and elevated serum total IgE values, eosinophilia, or basophilia (p>0.05). Among those diagnosed with food allergy, elevated serum total IgE values were detected in 50.0% of those aged ≤12 months and 76.5% of those older than 12 months. Overall, indicated number (%) of patients had elevated serum total IgE values (n=44; 55.7%), eosinophilia (n=48; 60.8%). and basophilia (n=3;.8%). Since all patients diagnosed with food allergy were in the atopic group, predictive analyses for atopy could not be performed for this group. Table 4 displays the relationships between peripheral blood parameters and atopy across different types of allergic diseases.

According to the Youden Index, the optimal cut-off value of serum total IgE for predicting atopic asthma was calculated as 108.5 kU/L (AUC: 0.854 [95% CI: 0.811–0.897], p<0.001), with a sensitivity of 85.6% and specificity of 76.6%. Furthermore, in patients with asthma, a significant correlation was found between the number of sensitizations identified by the skin prick test and serum total IgE levels (r=0.532, p<0.001).

DISCUSSION

This study focused on evaluating whether elevated serum total IgE, eosinophil, and basophil levels at the time of diagnosis can serve as predictive markers for atopy in various allergic diseases observed in a pediatric hospital setting. Additionally, skin prick and serum-specific IgE test results of the patients were assessed to determine atopy profiles of these patients. Egg was found to be the most common sensitizing allergen in patients with atopic dermatitis and food allergy, while tree pollens were the most common allergens in allergic rhinitis, and house dust mites in asthma. In asthmatic patients, elevated total IgE levels increased the likelihood of atopy by 16.4 times, and the cut-off value of total IgE for predicting atopy in asthma was calculated as 108.5 kU/L.

There is a strong association between atopic dermatitis and food sensitization, and early detection of these entities is essential to prevent disruption of the skin barrier.[1] Previous studies have shown that egg and milk are the most frequently observed allergens in food allergies in patients with atopic dermatitis, while rates of sensitivities to peanuts, soy, wheat, and fish vary across populations.[10–14] Consistent with the literature, our study found that egg was the most common sensitizing allergen based on serum-specific IgE results in patients diagnosed with atopic dermatitis. Wahn et al.[15] observed that sensitization to food allergens generally develops within the first year of life, while severity of sensitization to aeroallergens increases with age. In our study, 80.9% of patients with atopic dermatitis were infants, which explains their low sensitization rates to aeroallergens.

Avoiding trigger allergens plays a crucial role in the management of allergic rhinitis. Therefore, understanding the distribution of aeroallergens in the region where patients reside is necessary. According to our skin prick test results, the most common allergens inducing epicutaneous sensitization among children with allergic rhinitis were tree pollens (32.0%), followed by grass pollens (23.8%) and house dust mites (21.8%). In studies conducted in South Korea, USA, and China,

house dust mites were reported as the most common allergens in children with allergic rhinitis.[16–18] According to relevant studies performed in various regions of Turkey the most common allergens were house dust mites in Istanbul, and grass pollens in Sakarya[.19,20]The regional distribution of aeroallergen sensitization in our study is likely to be influenced by regional climatic features, vegetation, and allergen diversity. Additionally, the finding that sensitization was detected in only 68% of patients diagnosed with allergic rhinitis can be explained by the prexisting local allergic rhinitis in some patients.

In our study, the most common allergen sensitization detected by skin prick test in asthmatic children was to house dust mites (18.1%). Similarly, the literature supports that house dust mites are major aeroallergens involved in the development of asthma and also the most commonly detected sensitizers in skin prick testing.[21] A 16-year longitudinal study conducted in Istanbul on allergen sensitization in children with asthma reported a decline in rates sensitization to house dust mite since 2001, possibly attributed to periodic education on preventive measures against this allergen.[22]

Marsh et al.[23] identified 100 kU/L as the optimal serum total IgE level to distinguish allergic conditions in adults, and this cut-off value is widely used. However, due to the dynamic nature of serum total IgE levels in children, its association with the risk of allergen sensitization and atopic disease remains unclear. Wong et al.[24] reported that in infants younger than 6 months, total IgE levels rarely exceeded 100 kU/L due to immature IgE production, making it unsuitable for predicting disease in this age group. In our study, serum total IgE levels did not predict atopy in patients with atopic dermatitis which may be explained by the fact that most of these patients were under 12 months old, resulting in an uneven age distribution and age-dependent increase in total IgE levels. Although a higher rate of elevated serum total IgE values was observed in patients older than 12 months with atopic dermatitis, the relatively small number of patients in this age group limits the interpretation of this finding.

In contrast to atopic dermatitis, our study found a significant association between atopy and elevated serum total IgE levels in patients with allergic rhinitis and asthma. This finding supports the presence of a strong relationship between serum total IgE levels and atopy, especially in respiratory allergies. Gergen et al.[25] also reported significantly elevated total IgE levels in individuals aged 6 and above with asthma who were sensitized to at least one specific allergen. Similarly, Sherrill et al.[26] demonstrated a significant relationship between skin prick test positivity and high serum total IgE levels in asthmatic children.

In our study, elevated serum total IgE emerged as a strong predictor of atopy in patients with asthma, with an odds ratio of 16.37. Based on this significant value, a ROC analysis was conducted to assess the predictive power of total IgE for atopic asthma. With a threshold of 108.5 kU/L, this biomarker had 85.6%, sensitivity and 76.6%. specificity in predicting atopy in patients with asthma These findings suggest that serum total IgE could be a meaningful biomarker for predicting atopy in asthmatic children. However, we believe that this cut-off value should be validated in multicenter studies with larger sample sizes.

Eosinophilia has been identified as a risk factor for severe atopic dermatitis. Infants with eosinophilia and a family history of atopy have an increased risk of developing allergic diseases within the first 6 years of life.[27–30] Although eosinophilia was detected in 74.2% of patients with atopic dermatitis in our study, no significant association was found between eosinophilia and atopy. In a study examining the clinical significance of eosinophilia in food allergy, Noh et al.[31] reported a correlation between eosinophilia and food allergy in patients with atopic dermatitis. They observed a decrease in eosinophil counts following elimination diets and an increase after intake of oral food challenges. They also found eosinophilia in 63.0% (85/135) of patients with atopic dermatitis and food allergy. Similarly, 60.8% of patients with food allergy in our study had eosinophilia.

In our study, a significant association was found between eosinophilia and atopy in patients with allergic rhinitis and asthma. Similar findings have been reported in the literature. For example, Winther et al.[32] showed that eosinophil counts in patients with allergic rhinitis increased during the pollen season and returned to baseline after the season. Özçeker et al.[19] also reported a significant association between eosinophilia and allergen sensitization in allergic rhinitis. These results are consistent with our findings. On the other hand, the relationship between eosinophil counts and clinical severity of allergic rhinitis remains controversial in the literature, and there is no consensus on this issue[33,34].

Hu et al.[28] reported a significantly higher prevalence of basophilia in patients with atopic dermatitis compared to healthy controls, and that patients with severe atopic dermatitis had significantly higher basophil counts compared to those with mild disease. However, our study did not find basophilia to be a significant predictor of atopy.

Study Limitations

This study has several limitations. Firstly, the inclusion of different allergic diseases resulted in a heterogeneous study population. This issue was solved by conducting separate analyses based on initial diagnoses. The lack of a homogeneous age distribution due to differing age ranges at the time of diagnosis represents another limitation. Furthermore, as the classification of atopic and non-atopic groups relied solely on skin prick test and allergen-specific IgE results, potential false-negative results might have led to misclassification of some patients. Additionally, our study was single-center and retrospective in design. The findings need to be supported by larger scale multicenter studies.

CONCLUSION

In conclusion, our findings suggest that serum total IgE may serve as a valuable biomarker for predicting atopy, particularly in children with asthma, and could support the diagnostic process in clinical practice. It is important to ensure the absence of comorbid conditions when interpreting these laboratory values. Furthermore, given the age-dependent increase in total IgE levels, its use may be limited in children under the age of one year.

Ethics

Ethics Committee Approval:

This retrospective study was conducted after the approval of the Ethics Committee of……. (approval number: E-22/04-319, date: 06.04.2022).

Informed Consent:Retrospective study.

Author Contributions

Surgical and Medical Practices: …..;Concept: ……., Design: …..Data Collection or Processing: ……
Analysis or Interpretation: …….,
Literature Search: ….., Writing:

Conflict of Interest:

The authors have no conflict of interest to declare.

Financial Disclosure:

The authors declared that this study has received no financial support.

REFERENCES

1. Graham F, Eigenmann PA. Atopic dermatitis and its relation to food allergy. Curr Opin Allergy Clin Immunol. 2020 Jun;20(3):305-310. doi: 10.1097/ACI.0000000000000638.
2. Karaman S, Erdem SB, Nacaroğlu HT, Yazıcı S, Karkıner CŞ, Can D. Are infants with food allergy candidates for respiratory allergy? Turk Pediatri Ars. 2020 Dec 16;55(4):354-360. doi: 10.14744/TurkPediatriArs.2020.77785.
3. Backman H, Räisänen P, Hedman L, Stridsman C, Andersson M, Lindberg A, et al. Increased prevalence of allergic asthma from 1996 to 2006 and further to 2016-results from three population surveys. Clin Exp Allergy. 2017 Nov;47(11):1426-1435. doi: 10.1111/cea.12963.
4. Yücel E. İmmunglobulin E Yüksekliği Olan Çocuğa Güncel Yaklasım. Klinik Tıp Pediatri Dergisi. 2020;12(2):79-84. Available from: https://dergipark.org.tr/tr/download/article-file/1523501
5. Hemmings O, Kwok M, McKendry R, Santos AF. Basophil Activation Test: Old and New Applications in Allergy. Curr Allergy Asthma Rep. 2018 Nov 15;18(12):77. doi: 10.1007/s11882-018-0831-5.
6. Hanifin JM, Rajka G. Diagnostic features of atopic dermatitis. Acta Derm Venereol Suppl (Stockh). 1980;92:44-7. doi: 10.2340/00015555924447.
7. Muraro A, Werfel T, Hoffmann-Sommergruber K, Roberts G, Beyer K, Bindslev-Jensen C, et al. EAACI food allergy and anaphylaxis guidelines: diagnosis and management of food allergy. Allergy. 2014 Aug;69(8):1008-25. doi: 10.1111/all.12429.

8. Brożek JL, Bousquet J, Agache I, Agarwal A, Bachert C, Bosnic-Anticevich S, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) guidelines-2016 revision. J Allergy Clin Immunol. 2017 Oct;140(4):950-958. doi: 10.1016/j.jaci.2017.03.050.
9. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention, 2018 update [Internet]. Fontana, WI: Global Initiative for Asthma; 2018. Available from: https://ginasthma.org/wp-content/uploads/2019/01/2018-GINA.pdf
10. Sampson HA, McCaskill CC. Food hypersensitivity and atopic dermatitis: evaluation of 113 patients. J Pediatr. 1985 Nov;107(5):669-75. doi: 10.1016/s0022-3476(85)80390-5.
11. Eigenmann PA, Sicherer SH, Borkowski TA, Cohen BA, Sampson HA. Prevalence of IgE-mediated food allergy among children with atopic dermatitis. Pediatrics. 1998 Mar;101(3):E8. doi: 10.1542/peds.101.3.e8.
12. Atherton DJ, Sewell M, Soothill JF, Wells RS, Chilvers CE. A double-blind controlled crossover trial of an antigen-avoidance diet in atopic eczema. Lancet. 1978 Feb 25;1(8061):401-3. doi: 10.1016/s0140-6736(78)91199-6.
13. Han DK, Kim MK, Yoo JE, Choi SY, Kwon BC, Sohn MH, et al. Food sensitization in infants and young children with atopic dermatitis. Yonsei Med J. 2004 Oct 31;45(5):803-9. doi: 10.3349/ymj.2004.45.5.803.
14. Burks AW, Mallory SB, Williams LW, Shirrell MA. Atopic dermatitis: clinical relevance of food hypersensitivity reactions. J Pediatr. 1988 Sep;113(3):447-51. doi: 10.1016/s0022-3476(88)80626-7.
15. Wahn U, Warner J, Simons FE, de Benedictis FM, Diepgen TL, Naspitz CK, et al. IgE antibody responses in young children with atopic dermatitis. Pediatr Allergy Immunol. 2008 Jun;19(4):332-6. doi: 10.1111/j.1399-3038.2007.00643.x.
16. Kim DH, Park YS, Jang HJ, Kim JH, Lim DH. Prevalence and allergen of allergic rhinitis in Korean children. Am J Rhinol Allergy. 2016 May;30(3):72-8. doi: 10.2500/ajra.2013.27.4317.
17. Sedaghat AR, Phipatanakul W, Cunningham MJ. Characterization of aeroallergen sensitivities in children with allergic rhinitis and chronic rhinosinusitis. Allergy Rhinol (Providence). 2014 Jan;5(3):143-5. doi: 10.2500/ar.2014.5.0102.
18. He S, Li YJ, Chen J. Clinical features of allergic rhinitis in children of Shanghai, China. Genet Mol Res. 2016 May 9;15(2). doi: 10.4238/gmr.15028118.
19. Özçeker D, Kardelen AD, Sapmaz S, Uysal Ö, Güler N, Tamay Z. Allergy Skin Tests in Inner-City Children with Allergic Rhinitis Living in İstanbul. Eur Arch Med Res. 2018; 34 (4):258-61. doi: 10.5152/eamr.2018.07078.
20. Elmas B, Özdemir Ö. Sensitization Prevalence of Children with Allergic Rhinitis for Inhalant and Food Allergens in the Province of Sakarya, Turkey. J Acad Res Med. 2017 Aug;7(2):63-69. doi: 10.5152/jarem.2017.1218.
21. Dibek Misirlioğlu E, Reha Cengizlier M. Skin prick test results of child patients diagnosed with bronchial asthma. Allergol Immunopathol (Madr). 2007 Jan-Feb;35(1):21-4. doi: 10.1157/13099091.
22. Akcakaya N, Cokugras H, Camcioglu Y, Ozdemir M. Skin test hypersensitivity for childhood asthma in Istanbul during a period of 16 years. Allergol Immunopathol (Madr). 2005 Jan-Feb;33(1):15-9. doi: 10.1157/13070603.
23. Marsh DG, Bias WB, Ishizaka K. Genetic control of basal serum immunoglobulin E level and its effect on specific reaginic sensitivity. Proc Natl Acad Sci U S A. 1974 Sep;71(9):3588-92. doi: 10.1073/pnas.71.9.3588.
24. Wong CY, Yeh KW, Huang JL, Su KW, Tsai MH, Hua MC, et al. Longitudinal analysis of total serum IgE levels with allergen sensitization and atopic diseases in early childhood. Sci Rep. 2020 Dec 4;10(1):21278. doi: 10.1038/s41598-020-78272-8.
25. Gergen PJ, Arbes SJ Jr, Calatroni A, Mitchell HE, Zeldin DC. Total IgE levels and asthma prevalence in the US population: results from the National Health and Nutrition Examination Survey 2005-2006. J Allergy Clin Immunol. 2009 Sep;124(3):447-53. doi: 10.1016/j.jaci.2009.06.011.
26. Sherrill DL, Stein R, Halonen M, Holberg CJ, Wright A, Martinez FD. Total serum IgE and its association with asthma symptoms and allergic sensitization among children. J Allergy Clin Immunol. 1999 Jul;104(1):28-36. doi: 10.1016/s0091-6749(99)70110-7.
27. Liu FT, Goodarzi H, Chen HY. IgE, mast cells, and eosinophils in atopic dermatitis. Clin Rev Allergy Immunol. 2011 Dec;41(3):298-310. doi: 10.1007/s12016-011-8252-4.

28. Hu Y, Liu S, Liu P, Mu Z, Zhang J. Clinical relevance of eosinophils, basophils, serum total IgE level, allergen-specific IgE, and clinical features in atopic dermatitis. J Clin Lab Anal. 2020 Jun;34(6):e23214. doi: 10.1002/jcla.23214.
29. Borres MP, Björkstén B. Peripheral blood eosinophils and IL-4 in infancy in relation to the appearance of allergic disease during the first 6 years of life. Pediatr Allergy Immunol. 2004 Jun;15(3):216-20. doi: 10.1111/j.1399-3038.2004.00143.x.
30. Akan A, Azkur D, Civelek E, Erkoçoğlu M, Yılmaz-Öztorun Z, Kaya A, et al. Risk factors of severe atopic dermatitis in childhood: single-center experience. Turk J Pediatr. 2014 Mar-Apr;56(2):121-6. Available from: https://turkjpediatr.org/article/view/1332/1325
31. Noh G, Jin H, Lee J, Noh J, Lee WM, Lee S. Eosinophilia as a predictor of food allergy in atopic dermatitis. Allergy Asthma Proc. 2010 Mar-Apr;31(2):e18-24. doi: 10.2500/aap.2010.31.3312.
32. Winther L, Moseholm L, Reimert CM, Stahl Skov P, Kaergaard Poulsen L. Basophil histamine release, IgE, eosinophil counts, ECP, and EPX are related to the severity of symptoms in seasonal allergic rhinitis. Allergy. 1999 May;54(5):436-45. doi: 10.1034/j.1398-9995.1999.00910.x.
33. Zhu XJ, Lu MP, Chen RX, Zhu LP, Qi QH, Yin M, et al. Correlation of serum eosinophil cationic protein with the severity of allergic rhinitis in childhood. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi. 2012 Aug;47(8):628-32. doi: 10.3760/cma.j.issn.1673-0860.2012.08.004.
34. Chen ST, Sun HL, Lu KH, Lue KH, Chou MC. Correlation of immunoglobulin E, eosinophil cationic protein, and eosinophil count with the severity of childhood perennial allergic rhinitis. J Microbiol Immunol Infect. 2006 Jun;39(3):212-8. PMID: 16783451. Available from: https://pubmed.ncbi.nlm.nih.gov/16783451

Table 1. Demographic and clinical characteristics of the patients

Characteristics	
Gender, n (%)	
Male	423 (62.9)
Female	250 (37.1)
Allergic diseases, n (%)	
Atopic dermatitis	89 (13.2)
Food allergy	79 (11.7)
Allergic rhinitis	206 (30.6)
Asthma	299 (44.4)
Age (months), median (IQR)	
Atopic dermatitis	11 (6-12)

Food allergy	12 (7-12)
Allergic rhinitis	84 (60-132)
Asthma	72 (48-96)
Total patients????	60 (36-96)
Atopy, n (%)	
Present	406 (60.3)
Absent	267 (39.7)
Laboratory findings, median (IQR)	
Serum total IgE (kU/l)	99.6 (34.0-313.0)
Eosinophil count (/mm^3)	350 (190-630)
Basophil count (/mm^3)	40 (30-50)

Abbreviation: IQR, interquartile range

Table 2. Serum-specific IgE sensitization rates according to type of allergic disease

	Atopic dermatitis (N=89) n (%)	**Food allergy (N=79) n (%)**	**Allergic rhinitis (N=206) n (%)**	**Asthma (N=299) n (%)**
Serum-specific IgE sensitization to:	72 (80.9)	75 (94.9)	110 (53.4)	90 (30.1)
Egg	67 (75.3)	59 (74.7)	3 (1.5)	0 (0.0)
Milk	23 (25.8)	48 (60.8)	1 (0.5)	0 (0.0)
Food panel	33 (37.1)	34 (43.0)	3 (1.5)	0 (0.0)
Inhalant panel	0 (0.0)	1 (1.3)	73 (35.4)	63 (21.1)
Grass pollens	0 (0.0)	0 (0.0)	62 (30.1)	28 (9.4)
House dust mites	0 (0.0)	0 (0.0)	16 (7.8)	21 (7.0)

Table 3. Sensitization rates based on skin prick test results classified according to types of allergic disease

Sensitization	Atopic dermatitis (N=89) n (%)	Food allergy (N=79) n (%)	Allergic rhinitis (N=206) n (%)	Asthma (N=299) n (%)
Sensitization to:	56 (62.9)	68 (86.1)	131 (63.6)	99 (33.1)
House dust mites	1 (1.1)	0 (0.0)	45 (21.8)	54 (18.1)
Tree pollens	1 (1.1)	1 (1.3)	66 (32.0)	41 (13.7)
Grass pollens	1 (1.1)	0 (0.0)	49 (23.8)	29 (9.7)
Mold	0 (0.0)	0 (0.0)	38 (18.4)	40 (13.4)
Cat danders	0 (0.0)	0 (0.0)	33 (16.0)	31 (10.4)
Dog danders	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cockroach	0 (0.0)	0 (0.0)	6 (2.9)	5 (1.7)
Egg	52 (58.4)	51 (64.6)	2 (1.0)	0 (0.0)
Milk	18 (20.2)	31 (39.2)	2 (1.0)	0 (0.0)
Cereals	15 (16.9)	7 (8.9)	3 (1.5)	1 (0.3)
Tree nuts	3 (3.4)	1 (1.3)	1 (0.5)	0 (0.0)
Legumes	1 (1.1)	2 (2.5)	0 (0.0)	0 (0.0)
Seeds	2 (2.2)	1 (1.3)	0 (0.0)	0 (0.0)

Table 4. Association between peripheral blood markers and atopy in patients with different allergic diseases

Allergic Disease	Predictor Variable	Odds ratio	95% CI	p value

Asthma	Elevated total IgE (≥100 kU/l)	16.37	8.531-31.412	**<0.001**
	Eosinophilia	1.99	1.086-3.631	**0.026**
	Basophilia	3.15	0.754-13.121	0.116
Allergic rhinitis	Elevated total IgE (≥100 kU/l)	3.33	1.737-6.379	**<0.001**
	Eosinophilia	2.81	1.441-5.493	**0.002**
	Basophilia	5.02	0.626-40.218	0.129
Atopic dermatitis	Elevated total IgE (≥100 kU/l)	5.06	0.608-42.017	0.134
	Eosinophilia	2.99	0.857-10.414	0.086
	Basophilia	-	-	0.999

Abbreviation: CI, confidence interval