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ORIGINAL ARTICLE

Evaluation of inhalant allergen sensitivity in children diagnosed with atopic dermatitis

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ABSTRACT

Objective: Atopic dermatitis (AD) is a recurrent and inflammatory chronic skin disease, particularly common in children. In the context of our study, the aim is to determine the frequency of respiratory allergen sensitivity in children diagnosed with atopic dermatitis.

Material and Methods: In this descriptive study, conducted between October 2022 and October 2023, the medical records of patients aged 0-18 with atopic dermatitis who presented to the Pediatric Allergy and Immunology Clinic were retrospectively reviewed. The analysis included age, gender, eosinophil counts, and total IgE levels. The patients' IgE and eosinophil values were measured during their initial visit when they had complaints.

Results: When examining the food and inhalant allergen sensitivity of patients, the most common sensitivity was to house dust mites (30.6%), followed by egg allergen sensitivity (28.6%). Eosinophil percentage and total IgE levels were also statistically significantly higher in those with inhalant allergen sensitivity compared to those without ($p=0.003$ and $p<0.001$, respectively). The cut-off point for total IgE in predicting inhalant allergen sensitivity was determined to be 99.5. Sensitivity and specificity values for the cut-off point of total IgE were 71.6% and 70.9%, respectively.

Conclusion: In conclusion, this article assessed the frequency of inhalation allergen sensitivity in atopic dermatitis. Sensitivity to allergens such as house dust mites, eggs, and milk was determined to be increased, emphasizing the potential critical role of indoor environments in the pathogenesis of AD. Additionally, it was found that eosinophil percentage and total IgE values were significantly higher in those with inhalation allergen sensitivity. These findings are important for understanding the clinical characteristics of patients and developing effective treatment strategies.

Keywords: Atopic dermatitis, house dust mites, inhalant allergen.

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INTRODUCTION

Atopic dermatitis (AD) is a recurrent and inflammatory chronic skin disease, particularly common in children.[1] AD is a dermatosis observed in individuals with an atopic tendency, affecting approximately 20–25% of children and 2–3% of adults.[2] Genetic factors, immune dysregulation, impaired skin barrier function, environmental factors, and nutrition play significant roles in the pathogenesis of atopic dermatitis.[3]

According to the atopic march theory, the presence of atopy implies that children with eczema may develop airway allergies such as asthma or allergic rhinitis (AR) in later years.[4] Understanding the allergens that trigger the atopic process is crucial.[5] The identification of IgE-mediated allergies suspected based on the history and examination in childhood should rely on validated tests such as skin prick tests and serum-specific IgE tests. Allergy tests are essential for allergen avoidance, disease monitoring, treatment planning, and specific immunotherapy.[6] Allergens typically manifest as food allergies in early childhood but become more relevant as inhalant allergen sensitivity in older children and adolescents.[5] Well-known inhalant allergens include house dust mites, animal epithelia, pollens, and molds.[7,8]

As inhalant allergen sensitivity is frequently observed in patients with AD, where skin involvement is prominent, determining the frequency of sensitivity to these allergens is crucial for preventing exposure in the clinical control of the disease. In the context of our study, the aim is to determine the frequency of respiratory allergen sensitivity in children diagnosed with atopic dermatitis.

MATERIAL AND METHODS

Study Type and Design

In this descriptive study, conducted between October 2022 and October 2023, the medical records of patients aged 0–18 with atopic dermatitis who presented to the Pediatric Allergy and Immunology Clinic were retrospectively reviewed. During this period, patients with available records and diagnosed with atopic dermatitis were included in the study. The diagnosis of atopic dermatitis was made according to the Hanifin-Rajka diagnostic criteria. This study was conducted in accordance with the Declaration of Helsinki.

Measurements

The analysis included age, gender, presence of additional allergic diseases, eosinophil counts, and total IgE levels. The patients' IgE and eosinophil values were measured during their initial visit when they had complaints. The eosinophil count was determined from the peripheral blood smear or counter and values higher than 4% were considered eosinophilia. Specific IgE testing was performed to identify food and inhalant allergens in patients. Allergen-specific IgE measurements were conducted using ImmunoCAP (Thermo Fisher Scientific, Uppsala, Sweden). Specific IgE values equal to or greater than 0.35 kU/L were considered positive. For those with negative results in the specific IgE test, a skin prick test was also conducted. Epidermal skin prick tests were performed using allergen extracts (ALK-Abello, Madrid, Spain) along with a positive control (10 mg/dL of histamine phosphate) and a negative control (0.9% sterile saline). Horizontal and vertical measurements were performed for the indurations. Indurations were considered positive if the average diameter was at least 3 mm greater than the negative control. Allergen sensitivity was defined as a positive result either in the specific IgE test or the skin prick test.

Table 1: Patients' laboratory values

	n (%)
Gender (female/male)	127 (51.2)/ 121 (48.8)
	Median (min–max)
Age	3 years (1 month–18 years)
Absolute eosinophil count 10^3/uL	290.0 (10–1840)
Eosinophil (%)	3.3 (0.1–51.0)
IgE IU/ml	72.5 (1.0–8910.0)

IgE: Immunoglobulin E.

Statistical Analysis

For statistical analysis and recording of the data, SPSS for Windows 25.0 program was used. Descriptive results were presented with median, minimum and maximum values, numbers (n), and percentages (%). The normal distribution was evaluated with visual (graphics) and analytical methods (Kolmogorov–Smirnov/Shapiro–Wilk tests). For non-normally distributed data, the Mann–Whitney U test was used to compare two independent variables. Chi-square test was used for the comparison of categorical data. $P<0.05$ was accepted as the statistical significance level. Receiver Operating Characteristics (ROC) curve analysis was used for the predictive capacity of eosinophils (absolute) and eosinophils (%) values and serum total IgE for inhalant allergen sensitivity. Sensitivity and specificity values were calculated for cut-off points.

Ethics

The study was conducted with ethical approval obtained from the Ethics Committee of the Umraniye Training and Research Hospital, as per the decision numbered 449 dated 23/11/2023.

RESULTS

Fifty-one point two percent (n=127) of the patients were female and 48.8% (n=121) were male. The median age was 3.0 years, with a minimum age of one month and a maximum age of 18 years.

The median values for absolute eosinophil count, eosinophil percentage, and total IgE were 290.0 10^3/uL (10–1840), 3.3% (0.1–51.0), and 72.5 IU/mL (1.0–8910.0), respectively (Table 1).

When examining the food and inhalant allergen sensitivity of patients, the most common sensitivity was to house dust mites (30.6%), followed by egg allergen sensitivity (28.6%). After egg, milk sensitiv-

Table 2: Patients' food and inhalant allergen sensitivity

Food and inhalant allergen sensitivity	n	%
Inhalant allergen sensitivity		
House dust mites	76	30.6
Cat	31	12.5
Pollen	25	10.1
Food allergen sensitivity		
Egg	71	28.6
Cow milk	36	14.5
Peanut	19	7.7
Hazelnut	17	6.9
Walnut	5	2.0
Pistachios	1	0.4

ity was observed in 14.5% (n=36) of cases in terms of food allergen sensitivity. Among inhalant allergens, sensitivities to cat and pollen were 12.5% (n=31) and 10.1% (n=25), respectively (Table 2).

In patients, inhalant allergen sensitivity was detected in 35.5% (n=88), while food allergen sensitivity was identified in 34.3% (n=85). When evaluating factors associated with allergen sensitivity, it was observed that children with food allergen sensitivity were statistically significantly younger compared to those without food allergen sensitivity (p<0.001). Absolute eosinophil count, eosinophil percentage, and total IgE levels were considerably higher in children with food allergen sensitivity compared to those without (p<0.001, p=0.001, and p=0.006, respectively). There was no relationship detected between the presence of food and inhalant allergen sensitivity and gender (p>0.05). The age of children with inhalant or food allergen sensitivity was significantly higher than those without sensitivity (p<0.001). Total IgE levels and eosinophil percentage were also statistically significantly higher in those with inhalant allergen sensitivity compared to those without (p<0.001 and p=0.019, respectively). Absolute eosinophil count, eosinophil percentage, and total IgE levels were also statistically significantly higher in those with food allergen sensitivity compared to those without (p<0.001, p=0.001, p=0.006, respectively) (Table 3).

ROC analysis was performed to assess the predictive capacity of eosinophil and total IgE values for aeroallergen sensitivity in patients. The ROC analysis indicated low Area Under the Curve (AUC) values for absolute eosinophil and eosinophil percentage (0.549 and 0.590, respectively). Therefore, cut-off points, sensitivity, and specificity were not calculated for absolute eosinophil and eosinophil percentage. The cut-off point for total IgE in predicting inhalant allergen sensitivity was determined to be 99.5. The Area Under the Curve (95% CI) was found to be 0.797 (0.739–0.856) (p<0.001). Sensitivity and specificity values for the cut-off point of total IgE were 71.6% and 70.9%, respectively (Table 4).

Table 3: Factors associated with patients' allergen sensitivity

	Food allergen sensitivity		p	Inhalant allergen sensitivity		p
	No (n=163) Median (min–max)	Yes (n=85) Median (min–max)		No (n=160) Median (min–max)	Yes (n=88) Median (min–max)	
Age (years)	4.0 (0–18.0)	1.0 (0–16.0)	**<0.001**	1.5 (0–18.0)	5.5 (0–17.0)	**<0.001**
Absolute eosinopil count 10^3/uL	240.0 (20.0–1420.0)	390.0 (10.0–1840.0)	**<0.001**	280.0 (10.0–1700.0)	330.0 (0–1840.0)	0.204
Eosinopil (%)	2.9 (0.1–51.0)	4.3 (0.1–16.5)	**0.001**	3.1(0.1–12.7)	3.95 (0.1–51.0)	**0.019**
Total IgE (IU/ml)	59.0 (1.0–5627)	115.0 (2.0–8910.0)	**0.006**	37.0 (1.0–3942)	388.5 (6.0–8910.0)	**<0.001**
	n (%)	**n (%)**	**p**	**n (%)**	**n (%)**	**p**
Gender			0.081			0.777
Female	90 (55.2)	37 (43.5)		83 (51.9)	44 (50.0)	
Male	73 (44.8)	48 (56.5)		77 (48.1)	44 (50.0)	

IgE: Immunoglobulin E.

Table 4: Cut-off value, sensitivity, and specificity of total IgE in predicting inhalant allergen sensitivity

Total IgE	Sensitivity	Specificity	AUC	95% CI	p
Cut off value: 99.5	71.6%	70.9%	0.797	0.739–0.856	<0.001

AUC: Area under the curve; CI: Confidence interval; IgE: Immunoglobulin E.

DISCUSSION

In our study, the total IgE and eosinophil percentage of patients with detected inhalant allergen sensitivity were found to be significantly higher compared to those without detected sensitivity. Atopic dermatitis (AD) is a skin disease that typically arises from complex interactions between environmental factors, genetic predisposition, and allergic reactions. In this context, the role of inhalant allergen sensitivity in the development of AD is increasingly gaining importance. This article aims to assess the frequency of inhalant allergen sensitivity in atopic dermatitis and understand its impact on the course of the disease.

In patients, inhalant allergen sensitivity was detected in 35.5%, and food allergen sensitivity was identified in 34.3%. When examining patients' food and inhalant allergen sensitivity, the most common sensitivity was to house dust mites (30.6%), followed by egg allergen sensitivity (28.6%). Milk sensitivity was the second most common food allergen sensitivity after eggs, observed in 14.5% of cases. In another study conducted in our clinic, food allergen sensitivity was identified in 34.2% of AD patients, with 26.4% showing sensitivity to eggs and 12.2% to cow's milk.[9] In our study, sensitivities to inhalant allergens, specifically cat and pollen, were detected at rates of 12.5% and 10.1%, respectively. One of the key findings of our study is the notably high sensitivity to house dust mites. This suggests a critical role, particularly of indoor environments, in the pathogenesis of AD and the potential triggering of patients' symptoms. A study on inhalant allergen sensitivity in children with atopic dermatitis revealed significant variation in sensitivity rates among countries. Sensitivity to house dust mites was found to be 40% in South Africa and 33% in Australia, while sensitivity to cat epithelium was 21% in the United Kingdom, 21% in France, 20% in the Netherlands, and 19% in Australia. Sensitivity to pollen was reported as 16% in the United Kingdom and 14% in France.[10] Sensitivity to house dust mites and pollen in our study is comparable, while sensitivity to cat epithelium is found to be lower compared to the literature. In a study conducted in Kahramanmaraş, Türkiye, the most common inhalant allergen for preschool and school-age children was identified as grass pollen.[11] Compared to this study conducted in a different region, it can be said that in the Marmara region, the primary factor causing inhalation allergen sensitivity is house dust mites. The lower number of house dust mites in regions with a continental climate and at high altitudes, coupled with the increase in house dust mite numbers in coastal areas with a humid climate, may contribute to this difference.[12]

In our study, eosinophil percentage and total IgE values were statistically considerably higher in those with inhalant allergen sensitivity compared to those without sensitivity. In 80–85% of patients with atopic dermatitis, serum IgE antibody levels are elevated.[13] Eosinophils are a cell type that commonly increases in allergic reactions. In a study by Özçeker et al.,[14] it was found that in patients with atopic dermatitis and IgE levels >100 kU/L, there was a higher prevalence of allergen sensitivity. In patients with AD, there is a decrease in the number of T suppressor cells and circulating T lymphocytes.[15] As a result of T lymphocyte suppression, B lymphocytes increase IgE production. IL-4 acts by increasing IgE production from B lymphocytes, while IL-5 influences by activating eosinophils.[16–19]

In our study, the Area Under the Curve (AUC) values for absolute eosinophil and eosinophil percentage in ROC analysis, assessing the predictive capacity of eosinophil and total IgE values for aeroallergen sensitivity, were found to be low. The cut-off point for total IgE in predicting inhalant allergen sensitivity was determined to be 99.5. Sensitivity and specificity values for the cut-off point of total IgE were found to be 71.6% and 70.9%, respectively. In a study conducted by Saglam et al.,[20] the predictive capacity of absolute eosinophil, eosinophil percentage, and total IgE values for test positivity (skin prick test and/or specific IgE positivity) was evaluated using ROC curve analysis. The cut-off point for total IgE was 104.5 in all patients (AUC: 0.789). Sensitivity and specificity were 72.0% and 71.9%, respectively. In our study, the cut-off point for predicting inhalant allergen sensitivity with total IgE was found to be lower compared to this study, with similar sensitivity and specificity ratios determined.

Limitations and Strengths

The retrospective nature of our study, the small number of patients, and its conduct at a single center constitute limitations in terms of the generalizability of the results. Additionally, evaluating laboratory findings such as IgE and eosinophils in patients with allergen sensitivity provides a broad perspective and constitutes strengths of the study.

CONCLUSION

In conclusion, this article assessed the frequency of inhalation allergen sensitivity in atopic dermatitis. Sensitivity to allergens such as house dust mites, eggs, and milk was determined to be increased, emphasizing the potential critical role of indoor environments in the pathogenesis of AD. Additionally, it was found that eosinophil percentage and total IgE values were considerably higher in those with inhalation allergen sensitivity. These findings are important for understanding the clinical characteristics of patients and developing effective treatment strategies. Evaluating inhalation allergen sensitivity in the treatment of atopic dermatitis can be a crucial step in managing patients.

Statement

Ethics Committee Approval: The Ümraniye Training and Research Hospital Clinical Research Ethics Committee granted approval for this study (date: 23.11.2023, number: 449).

Author Contributions: Concept – UA, SÇ; Design – ZMA; Supervision – SÇ; Resource – MYÖ; Materials – UA; Data Collection and/or Processing – MYÖ; Analysis and/or Interpretation – ZMA; Literature Search – SÇ; Writing – UA; Critical Reviews – ZMA, SÇ.

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