Sensitization to Inhalant Allergens in Children Under Three Years

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ABSTRACT

Background: Recent studies indicate that allergic sensitization may initiate during infancy, encompassing sensitivities to inhalant allergens.

Objective: The goal of this study is to assess the importance and patterns of sensitization to airborne allergens in children younger than three years old.

Methods: We conducted a retrospective analysis of 17 children aged between 12 and 36 months who had confirmed sensitization to at least one inhalant allergen. The sensitization was verified through skin prick testing (SPT) and/or serum-specific IgE testing. We evaluated clinical symptoms, comorbid conditions, and the family history of atopy.

Results: The study included 17 children (8 males,9 females; mean age: 22 months). The most common presenting symptom was wheezing (82,3%), followed by eczema exacerbations (17,6%), and allergic rhinitis 17,6%). A first-degree family history of atopy was identified in 52% of the cohort. Among the individuals studied, 9 (64.2%) were found to be sensitive to ragweed allergens, 5, (29.4%) were sensitive to grass, and 4 (28.5%) were sensitive to dust mite allergens (D. pteronyssinus and D. farinae), which were the most common allergens. Mean total IgE was 358.5 IU/mL (range: 9.7-1330), and mean eosinophil count was 333,5/μL (range: 13-1000). Although children with a family history of atopy showed higher mean IgE and eosinophil levels, differences were not statistically significant (p=0.2, p=0.48).

Makalenin geliş tarihi: 26/05/2025 - Makale Kabul Tarihi: 19/06/2025
Sorumlu Yazar: Hülya Köse
DOİ:10.17932/IAU.ASD.2015.007/asd_v011i2004

Conclusion: Sensitization to airborne allergens in children under three years is linked to significant symptoms and family atopy. Early testing can guide preventive and therapeutic interventions

Key words: Infant, early sensitization, inhalant allergens

Üç Yaş Altı Çocuklarda İnhalan Alerjenlere Duyarlılık

ÖZET

Arka Plan: Son çalışmalar, alerjik duyarlılığın bebeklik döneminde başlayabileceğini ve inhalan alerjenlere karşı duyarlılıkları kapsayabileceğini göstermektedir.

Amaç: Bu çalışmanın amacı, üç yaşından küçük çocuklarda inhalan allerjen duyarlılığı değerlendirmektir.

Yöntemler: En az bir inhalan alerjene duyarlılığı doğrulanmış 12 ila 36 aylık 17 çocuğun retrospektif analizini gerçekleştirdik. Duyarlılık, deri prick testi (SPT) ve/veya serum spesifik IgE testi ile doğrulandı. Klinik semptomları, eşlik eden hastalıkları ve ailede atopi öyküsünü değerlendirdik.

Sonuçlar: Çalışmaya 17 hasta (8 erkek, 9 kız; ortalama yaş: 21,6 ay) dahil edildi. En sık görülen semptom hışıltıydı (n:15,%83,3), egzama alevlenmeleri (n=3 ,%17,6) ve alerjik rinit (n=3, %17,6) izledi. Kohortun %56'sinde birinci derece atopi aile öyküsü belirlendi. Hastalar arasında 10'unun (%58,8) ragweed alerjenlerine duyarlı olduğu bulunurken, 5 hasta çimen (%29,4) polenlerine, 4 hastanın (%23,5) akar alerjenlerine (D. pteronyssinus ve D. farinae) duyarlılık gösterdiği görüldü. Ortalama total IgE 358,5 IU/mL (: 9,7-1330) ve ortalama eozinofil sayısı 333,5/µL(13-1000) idi. Ailesinde atopi öyküsü olan çocuklarda daha yüksek ortalama IgE ve eozinofil düzeyleri görülmesine rağmen istatistiksel olarak anlamlı fark bulunmadı (p=0,2, p=0,48).

Sonuç: Üç yaşın altındaki çocuklarda inhalan alerjenlere duyarlılık önemli semptomlara yol açabilir ve aile atopi öyküsü ile bağlantılıdır.

Anahtar sözcükler: infant, erken duyarlılık, inhalan alerjenler

INTRODUCTION

Allergic conditions, including eczema, food allergies, hay fever, and asthma, frequently begin in early childhood and can develop in a sequence referred to as the atopic march. The process of sensitization, which involves the formation of allergen-specific IgE, occurs prior to the clinical appearance of allergic conditions and is a vital immunological step in this progression (1). While food allergens have long been considered the primary triggers of sensitization in early life, increasing evidence indicates that inhalant allergens—like house dust mites (Dermatophagoides spp.), pet dander, and molds—can initiate IgE-mediated responses even during infancy (2).

The early development of sensitization to inhalant allergens has important clinical consequences. It contradicts the traditional belief that environmental sensitization usually follows food sensitization and occurs only later in childhood (3). In fact, sensitization can happen simultaneously with or even before the onset of clinical symptoms, potentially influencing the severity and duration of the disease (3). Several prospective birth cohort studies have demonstrated early sensitization to aeroallergens and their predictive value for developing asthma and allergic rhinitis later in life (4,5). Despite this, there is still a scarcity of clinical data specifically concerning inhalant sensitization in children younger than 3. This research intends to determine the allergen profile and clinical characteristics of young children with verified inhalant allergen sensitization. We also examine their symptoms and family history to identify risk factors and enhance early diagnosis and treatment.

METHODS

We performed a retrospective review of medical charts for pediatric patients aged 12 to 36 months who visited our allergy clinic over a two-year period. We gathered demographic data, allergy test findings, clinical symptoms (such as wheezing, rhinitis, eczema), associated conditions, and family history regarding atopy. (Ethical approval number is 191 on 6/7/2024).

Skin prick tests were performed using standardized extracts including ragweed, grass mix, Dermatophagoides pteronyssinus, D. farinae, and Aspergillus spp. Histamine (10 mg/mL) and saline/glycerol solution were used as positive and negative controls, respectively. Wheal diameters ≥3 mm more than the negative control were considered positive. Serum-specific IgE was measured via Immuno-CAP (ThermoFisher Scientific), with ≥0.35 kU/L defined as positive.

Statistical analysis of data

SPSS version 24.0 (SPSS, Inc.; Chicago, USA) was utilized to create the database and conduct statistical analyses. Descriptive statistics are presented as number (n), percentage (%), mean, standard deviation (SD), and median. Kolmogorov-Smirnov and Shapiro-Wilk tests were applied to assess data normality. A two-sample t-test was used for independent sample groups with normal distribution, while the Mann-Whitney-U test was used for those without. A p-value of less than 0.05 is considered statistically significant.

RESULTS

A total of 17 children (9 females and 8 males; ages ranging from 12 to 36 months). The most common presenting symptom was wheezing (82,3%), followed by eczema exacerbations (17,6%). The diagnostic distribution is given in Table 1.

Table 1: The diagnostic distribution of the cohort

Diagnosis	n,%
Wheezy Infant	14 (82,3)
Eczema	3(17,6)
Allergic Rhinitis + Conjunctivitis	3(17,6)
Total	**17**

Allergen Sensitization Profile:

The most prevalent allergen sensitivity observed in the cohort is Ragweed, documented in 10 cases (58.8%). Grass allergy was identified in 5 cases (29.4%). Sensitivities to Dermatophagoides pteronyssinus and Dermatophagoides farinae were each noted in 4 cases (23.5%). The details regarding allergen sensitization are presented in Table 2.

Table 2: Allergen Sensitization Profile

Allergen	Number of Patients (n)	Percentage (%)
Ragweed	10	*58.8%*
Grass	5	29.4%
Dermatophagoides pteronyssinus	4	23.5%
Dermatophagoides farinae	4	23.5%
Aspergillus spp.	2	11.7%
Polysensitization (≥2 inhalant allergens)	2	11.7%

All patients exhibited negative results on skin prick tests for food allergies and reported no symptoms related to food consumption.

Atopic Background
Fifty-six percent of the children had a first-degree relative with a history of atopic conditions such as asthma and allergic rhinitis.

The mean total IgE was 358 (9,7-1330)IU/mL, and the mean eosinophil count was 333,5 (13-1000)cells/μL. In those with atopy history, the mean total IgE was 280,9 (9,7-1330)IU/mL and the mean eosinophil count was 346(13-1000)cells/μL, in those without atopy history, the mean total IgE was 144.50 (9.70-465) IU/mL and the mean eosinophil count was 130 (34-320)cells/μL, when the two groups were compared, it was not found to be statistically significant (p=0.2,0.48 respectively). The values are depicted in Table 3.

Table 3: Total IgE and absolute eosinophil counts

Parameter	Value
Total Number of Patients	17
Positive Skin Prick Test (%)	15, 88,2%
Mean Total IgE (IU/mL)	358.5((9,7-1330)
Mean Eosinophil Count (cells/μL)	333.5(13-1000)

DISCUSSION

Inhalant allergens such as pollen, dust mites, mold spores, and pet dander significantly contribute to respiratory allergies, especially in infants (6). Recognizing the sensitivity of children under three years old to these allergens is essential for early intervention and management. Infants are at a crucial developmental stage, making them particularly vulnerable to allergic sensitization. During this period, their immune systems are still maturing, which affects their response to allergens. This sensitization often occurs through inhalation, as allergens enter the respiratory tract. Infants may display symptoms such as sneezing, coughing, wheezing, or a runny nose when they encounter inhalant allergens. Early recognition of these symptoms can lead to effective treatment(7).

This research indicates that sensitivity to inhalant allergens, particularly ragweed and house dust mites, can occur as early as 12 months old and is often accompanied by respiratory and skin-related symptoms in infants. Our findings support the notion that early sensitization to inhalants is not just a singular immunological event but a crucial clinical occurrence that may signal the beginning of the atopic trajectory.

Our group's high levels of sensitization to dust mites align with environmental exposure patterns observed in early childhood. These allergens are commonly found indoors and are especially significant in environments with inadequate ventilation or carpeting. Prior research has indicated that sensitization to dust mites during infancy is linked to a heightened risk of wheezing, decreased lung function, and asthma later in childhood (8). Likewise, exposure to cat and mold spores has been associated with ongoing allergic rhinitis and increased bronchial sensitivity (9). The frequent occurrence of wheezing among our patients indicates that symptoms might present early and coincide with viral infections, which could postpone diagnosis. Importantly, these symptoms were observed in a group with a significant family history of atopy (80%), underscoring the joint impact of genetic and environmental factors on early allergic sensitization. Moreover, the presence of eczema flare-ups in 14.2% of children indicates that a malfunction in the skin barrier might enable allergens to infiltrate and cause sensitization. This is particularly important given the growing evidence linking impaired skin integrity, such as that resulting from mutations in the filaggrin gene, to both eczema and allergen sensitization (10,11). Our research underscores the significance of carrying out early allergy evaluations—employing skin prick tests or specific IgE measurements—even in kids under 3, particularly when symptoms indicate an allergy or when there are familial risk factors.

The findings of this study indicate that inhalant allergen sensitization in early childhood warrants serious consideration. In clinical practice, this suggests that children under three years old presenting with atopic symptoms—especially those with a family history of atopy—should be assessed for inhalant allergens at an earlier stage. Previous research has shown that sensitization to inhalant allergens during the preschool years is linked to a heightened risk of developing asthma and allergic rhinitis later in life (12, 13).Our findings support the association between sensitization—particularly to house dust mites and grass pollens—and its detection in very young children. The observation that children with elevated total IgE levels and higher eosinophil counts are more likely to show sensitization highlights the clinical significance of these markers for early diagnosis and intervention. These results are in line with the existing literature (14,15) and provide valuable population-based data from our region. Additionally, implementing standardized testing protocols and specific IgE measurement techniques improves the comparability of our findings across various clinical centers. Future longitudinal studies are essential to further explore the long-term clinical implications of early allergen sensitization.

Limitations of the study include the small sample size, retrospective design, single-center recruitment, and lack of follow-up data. Larger, prospective studies are needed to validate early screening and management approaches in this age group.

CONCLUSION

Sensitivity to inhalant allergens in children younger than three is uncommon but important from a clinical perspective. It is associated with respiratory and skin issues, as well as a significant family history of atopy. Prompt identification and testing may facilitate preventative strategies, like avoiding allergens and implementing timely interventions, to affect the atopic march.

Ethical approval: Diyarbakir Childrens' Hospital Ethics Committee, the study number is 191 on 6/7/2024.

Conflicts of interest declaration

We declared that we have no commercial, financial, or other relationships related to this article's subject that might create any potential conflict of interest. Informed consent was taken from the patients.

Author contribution

HK and KE performed material preparation, data collection, and analysis. HK wrote the main manuscript. KE performed statistical analysis and made tables. All authors read and reviewed the final manuscript. All authors read and approved the final manuscript.

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Tables:

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