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Retrospective Evaluation of Eosinophil Counts and Total IgE Levels in Children with Scabies

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ABSTRACT

Scabies is a common parasitic skin infestation in children that may cause elevated eosinophil counts and total IgE levels. Because these findings resemble those of atopic dermatitis and other allergic diseases, scabies is often misdiagnosed, leading to unnecessary allergy referrals. This study aimed to determine eosinophil counts and total IgE levels in children diagnosed with scabies, assess their frequency, and highlight the importance of considering scabies in the differential diagnosis of atopic and allergic conditions.

This retrospective cross-sectional study included children aged 0–18 years diagnosed with scabies according to the 2020 International Alliance for Scabies Control criteria before October 30, 2024, who were referred to the Pediatric Allergy and Immunology Clinic of Osmaniye State Hospital. Data on patients' demographics, family history of scabies, bacterial skin infections, eosinophil counts, total IgE levels, and treatment were collected from medical records.

Of all patients, 32.2% were female and 67.8% male, with a median age of 30 months. The median eosinophil count was 516.88/μL, and the mean total IgE level was 427.44 IU/mL. The median eosinophil percentage was 5.58%; 53.9% had eosinophil percentages ≥4%, and 53% had total IgE levels ≥100 IU/mL. Additionally, 40% had no family history of scabies, and 23% had bacterial skin infections.

More than half of the patients exhibited elevated eosinophil counts and total IgE levels. In children presenting with pruritus and rash, scabies should be considered in the differential diagnosis, especially when eosinophilia or high IgE is present.

Keywords: Child, Eosinophil, Skin Rash, Scabies, Total IgE.

Introduction

Scabies is a skin infection caused by the *Sarcoptes scabiei* var. hominis mite and is characterized by itching and rashes due to damage (tunneling) in the skin (1). The scabies rash is an itchy parasitic dermatosis that usually affects a significant part of the body, especially the wrists, between the fingers, underarms, groin area, penis, lower back and buttocks (2).

Scabies poses a major risk in overcrowded societies with limited resources due to human-to-human transmission and shared use of personal items (3). The intense itching and tissue damage caused by scabies result in skin barrier disruption, creating a predisposition to severe bacterial infections (4, 5). Furthermore, the intense itching and visible skin eruptions may lead to social exclusion in children, along with psychological issues, academic failure, and sleep disturbances (6). In other words, the problems induced by scabies represent a substantial burden on individuals, families, and communities (7).

Scabies affects approximately 200 million people worldwide, with prevalence varying from 1% to 72% depending on the socioeconomic status of the population (8). In Turkey, school report results revealed a prevalence of approximately 33% in children, with periodic regional increases (9, 10).

Epidemiological studies identify factors such as poverty, overcrowded conditions, seasonal variations, poor hygiene, lack of knowledge, and the level of development of the community as major contributors to the spread of scabies (11). Scabies is common in all ages but is more common in children in underdeveloped, populated regions of the World (12).

In scabies patients, the increase in IL-4 and IL-5 causes both eosinophilia and elevated total IgE levels (13). Eosinophilia is defined as an eosinophil count of 3-5%. Mild eosinophilia

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ranges from 500-1500 eosinophils, moderate eosinophilia from 1500-5000, and severe eosinophilia occurs when the eosinophil count exceeds 5000. Common causes of eosinophilia include parasitic infections, allergic diseases, drug reactions, rheumatological diseases, adrenal insufficiency and immune deficiencies (14). A total IgE level >100 UI/mL in children indicates a significant risk of allergic diseases. Total IgE may increase in infections (parasitic, viral, fungal), allergic diseases, immune deficiencies and malignancies (15).

The primary objective of this study was to retrospectively determine previously measured eosinophil and total IgE levels in children with scabies. While studies in the literature indicate that scabies can cause eosinophilia and elevated IgE levels, little is known about the frequency of these increases. This study aims to fill this gap in the literature by retrospectively collecting data from patients referred to us after their pediatricians had their eosinophil and total IgE levels checked. Therefore, pediatricians are encouraged to consider scabies in the differential diagnosis of patients with elevated eosinophil and/or IgE levels. This study will contribute to the literature in this respect.

Materials and Methods

Study Population: This study was conducted as a retrospective and cross-sectional design. Patient records of children aged 0-18 years who were diagnosed with scabies according to the 2020 IACS criteria before October 30, 2024 and referred to the Pediatric Allergy and Immunology Clinic were reviewed. Patients' age, gender, scabies symptoms in the family, bacterial skin infection in the patient, eosinophil, total IgE levels and treatment were recorded.

The scabies diagnosis was made according to the 2020 International Alliance for the Control of Scabies Consensus Criteria (2020 IACS criteria) (16).

Clinical scabies diagnosis is made by demonstrating one of these three features. Diagnosis is made by demonstrating scabies burrows. Or by demonstrating the presence of typical lesions affecting the male genital organs. Or by demonstrating the presence of scabies lesions with a typical distribution.

He had given information about scabies to the patients. He had started two doses of topical permethrin solution at one-week intervals and daily oral antihistamine to reduce itching. It was recommended that this treatment be applied to all family members. Oral ivermectin was started for patients who did not comply with this treatment or were resistant. It was recommended that bed linen, bedding and common items be washed at at least 60-70 degrees. Local antibiotic treatment was given to patients with bacterial skin infections.

Exclusion Criteria: Patients with allergic diseases (atopic dermatitis, food allergy, drugs, allergy, asthma, allergic rhinitis, etc.), vasculitic diseases associated with eosinophilia, viral infections, and other parasitic diseases were excluded from the study.

Inclusion criteria: Patients who had previously undergone a physical examination in our clinic, were diagnosed with scabies in the clinical examination according to the 2020 IACS criteria, had laboratory values, age, family history of scabies, presence of bacterial infection on the skin, and did not meet the exclusion criteria were included in the study.

Ethics Committee Approval: The ethical protocol was approved by Osmaniye Ata University Non-Interventional Clinical Research Ethics Committee, approval number (Date 18.11.2024 and number 206623). The study was conducted by the Helsinki Declaration.

Sample Size: Since this study had a retrospective design, an a priori sample size calculation and power analysis could not be performed. Therefore, the adequacy of the available sample size (n = 115) was assessed through a post hoc power analysis based on total IgE values reported in healthy children in the literature. Kardar et al. provided reference ranges for total IgE levels across different pediatric age groups (15). When compared with these reference values, the median total IgE level observed in our cohort of children with scabies (427.44 IU/mL) was markedly above the upper limits of the normal range. In line with previous studies demonstrating significantly elevated IgE levels in scabies patients, a conservative assumption of a large effect size (Cohen's d ≈ 0.8–1.0) was adopted for the power calculation. Using G*Power 3.1 with an alpha level of 0.05 and the final sample size of 115 patients, the post hoc analysis indicated that the statistical power exceeded 90% for detecting clinically meaningful increases in total IgE. Similarly, because eosinophil levels in our cohort were also substantially elevated compared with normal reference values, the present sample was considered statistically adequate to evaluate eosinophilia in children with scabies.

Statistical Analysis: The study data was analyzed using IBM SPSS Statistics for Windows (Version 21.0. Armonk, NY: IBM Corp.). Categorical variables were expressed as numbers (n) and percentages (%). Since our descriptive statistics data were not normally distributed, median values along with the 25th and 75th percentiles (IQR) were reported. Descriptive statistics, skewness and kurtosis coefficients, histograms, and a Kolmogorov-Smirnov test were employed to assess the normality of distribution for continuous variables. The chi-square test was used to analyze categorical variables, while the Mann-Whitney U test was used to compare two independent groups with non-normally distributed variables.

Results

A total of 160 children were initially included in the study. After retrospective laboratory data review, 25 patients without eosinophil and IgE levels, 5 patients with atopic dermatitis, and 15 patients diagnosed with asthma were excluded, and 115 patients were included in the study. Of these patients, 32.2% were female and 67.8% were male. Median age was 30 months (IQR: 12-78 months). In 40% of our patients, other family members did not have scabies symptoms. In 23% of our scabies patients, skin rashes were infected. Demographic characteristics are presented in Table 1. ($p>0.05$).

Our patients' clinical features included pruritic papular, eczematous, and vesicular rashes affecting a significant portion of the body, particularly the wrists, interdigital spaces, groin, glans skin, lower back, and buttocks. Vesicular lesions were also frequently observed on the palms and soles of the feet in children 1 year of age and younger. The patients were informed about scabies. Topical permethrin solution was applied in two doses, 1 week apart, to reduce itching, and oral antihistamines were used daily to relieve itching. This treatment was administered to all family members. Oral ivermectin was administered to patients who were resistant to or did not comply with this treatment. Forty percent of our patients had no family history of scabies. All patients continued to have symptoms for 4-6 weeks after treatment. Ivermectin was also used in one-third of our patients.

The median eosinophil count was 516.88 (range: 2.60-1980) and the median total IgE level was 427.44 (IQR: 8.73-2500). The median eosinophil percentage was 5.58% (IQR: 0.50%-13.40%) and 53.9% of patients had eosinophil percentages ≥4%. In addition, 53% of patients had total IgE levels ≥100 IU/mL. The comparison of eosinophil and total IgE parameters of the patient group according to gender is presented in Table 2.

Discussion

In this study, we wanted to reveal the total IgE and eosinophil elevation in the laboratory of children with scabies. As it is frequently misdiagnosed as an allergic disease, it is crucial to focus on this issue.

A total of 115 patients were included in the study. Of these, 32.2% were female and 67.8% were male, with a median age of 30 months. All patients presented with pruritic eruptions, which affected significant portions of the body, especially the wrists, between the fingers, groin, penis, lower back, and buttocks. Children aged 1 year and younger often presented with vesicular lesions on the palms and soles. Many patients also had scabies symptoms in other family members. Despite this, forty percent of the patients had no family history of scabies.

All of our patients had rashes, and nearly all had itching. The itching was particularly pronounced at night and often caused sleep disturbances. The rash and itching caused embarrassment in the family and led them to try to conceal the disease. Therefore, the absence of scabies symptoms in approximately 40% of our patients may be due to concealment of the disease. We know that this disease is transmitted through contact.

Nonspecific lesions such as excoriated papules, eczematous or lichenified plaques, and nodules are common in scabies, with the rash often being confused with eczema (17). Moreover, the rash and itching are the host's immune response to the parasite. This immune response's basic mechanism is activating mast cells, causing the release of histamine, tryptase, and TNF-alpha (18). Another mechanism is the activation of macrophages, which increase the production of prostaglandins and leukotrienes. In addition, itching occurs through pruriceptor activation via interleukins produced in response to Th1 and Th2 (13).

In 23% of our patients, the skin rash was infected. This skin infection can lead to more serious complications. The cause of this infection is largely the depression of the immune system. The *S. scabies* parasite blocks the three pathways of the complement system (classical, alternative and lectin pathways) by binding to some plasma proteins involved in the pathways of the

Table 1: Demographic Characteristics of Patients

Parameter	Female	Male	p
n (%)	37 (32.2%)	78 (67.8%)	0.232[a]
Age, month, median (IQR)	30.00 (12.00–90.00)	30.00 (12.00–72.00)	0.236[b]
Scabies positive in family, n (%)	22 (19.13%)	24 (20.86%)	N.A.
Patients with infected skin, n (%)	14 (12.17%)	13 (11.30%)	N.A.
Patients taking ivermectin, n (%)	17 (14.78%)	20 (17.39%)	N.A.

Footnote:
[a]Chi-square test.
[b]Mann–Whitney U test.
Continuous data are presented as median (IQR: interquartile range).
N.A.: Not applicable – statistical comparison could not be performed due to insufficient subgroup size or data not suitable for analysis

Table 2: Total IgE and Eosinophil Levels of Patients According to Gender

Parameter	Female	Male	p
Eosinophil (cells/μL), median (IQR)	340.00 (260.00–460.00)	440.00 (270.00–780.00)	0.235[b]
Eosinophil (%), median (IQR)	4.00 (3.30–5.50)	4.10 (3.00–8.00)	0.528[b]
Total IgE (IU/mL), median (IQR)	68.60 (31.74–275.30)	143.30 (54.63–542.00)	0.250[b]

Footnote:
[b] Mann–Whitney U test.
Data are expressed as n (%) or median (IQR: interquartile range).
N.A.: Not applicable – analysis could not be performed due to limited data availability or inappropriate subgroup distribution

complement system. It does this by using intestinal serine protease (19). Suppression of the complement system can frequently cause pyoderma with group A streptococcus and similar bacteria (20).

The median eosinophil count was 516.88, and the median total IgE level was 427.44. The median percentage of eosinophils was 5.58%, with 53.9% of patients showing eosinophil percentages ≥ 4%. Furthermore, 53% of patients had an IgE level ≥ 100 UI/mL. This result indicates that more than half of the patients had elevated eosinophils and IgE levels. Previous studies have shown that parasitic diseases, including scabies, can lead to eosinophilia and elevated total IgE levels, and our findings align with these results (13).

High production of interleukin-5 as a host immune response to the parasite that causes scabies causes both tissue and peripheral eosinophilia (21). It increases total IgE production by inducing B cell class change with IL-4 and IL-13 produced as the body's immune response against the *S. scabies* parasite (22). Other studies suggest that the scabies mite stimulates IL-4 and IL-13 (Th2 cytokines), leading to B cell class switching and subsequent IgE production (23). Additionally, scabies mites stimulate IL-4, IL-5, and IL-13 production, resulting in both eosinophilia and elevated total IgE levels (24). Our study also shows the frequency of these eosinophil and total IgE elevations.

Patients were informed about scabies. Topical 5% permethrin and oral antihistamines were used to reduce itching. Treatment was repeated after one week and recommended for all family members. Oral ivermectin was given to resistant or non-compliant patients, with successful outcomes. Hygiene measures were advised, and topical antibiotics were prescribed for bacterial skin infections. Patients were informed that symptoms may persist for 4–6 weeks (25).

The strengths of our study include both high eosinophil counts and high total IgE levels. In particular, the frequency of eosinophil and total IgE loads is demonstrated. However, the limitations of our study include its single-center design, its reliance on clinical diagnosis, and its retrospective nature.

Scabies is a common condition encountered in pediatric allergy and immunology clinics, often due to elevated eosinophil and total IgE levels. Our study emphasizes that scabies should be considered in the differential diagnosis of children presenting with these laboratory findings, as it is

frequently misdiagnosed as an allergic disease, particularly in the absence of family symptoms. Highlighting this diagnostic challenge can improve clinical awareness and prevent misdiagnosis. Early recognition and appropriate treatment not only relieve patient symptoms but also prevent spread within families and communities. Our findings fill this gap and contribute valuable information to the literature, reinforcing the importance of including scabies in the evaluation of children with unexplained eosinophilia and elevated IgE levels.

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