

Immunological study of temporal changes in total serum IgE levels among patients with bronchial asthmatic respiratory infection of Iraqi children: A comparative study (2022-2026)

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Abstract

Patients with Bronchial Asthmatic Respiratory Infection and Allergic asthma is characterized by typical asthmatic symptoms following exposure to airborne allergens and IgE allergy. Objective: The study examines the highest IgE levels in children with asthma and compares them in two different periods (2022 and 2026). The current cross-sectional study included 122 children with asthma between January 25 and May 24, 2026, as well as 85 individuals from Iraqi Teaching Hospital for Children between June 2022 and October 2022. The Accu-Bind IgE ELISA kit was used to measure the total IgE level. Since many laboratories consider IgE levels > 100 kU/L to be elevated, a level of 100 units/mL was selected to distinguish between high and low IgE groups. The degree of asthma severity in Iraqi children was high in 2026 compared with 2022. In 2026, the percentage of moderate and severe asthma cases was 45.08% and 13.93%, respectively, while in 2022, the percentage of moderate asthma was only 34.12%. The total levels of IgE increased significantly in 2026 in children with asthma (297.55 ± 251.56 IU/ml) compared with asthmatic children in 2022 (224.71 ± 231.01 IU/ml) ($p=0.035$). In 2026, the number of asthmatic children with IgE total of more than one hundred IU/ml was 70.49% of the total asthmatic children, while in 2022, only 50.59% of asthmatic children had a total IgE > 100 IU/ml. From 2022 to 2026, an increase was found in the total IgE levels in Iraqi asthmatic children, which was accompanied by a worsening asthma severity.

Keywords: Asthma, Children, IgE, Severity, Respiratory infection.

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Introduction

One of the most prevalent chronic, non-communicable diseases in children and adults worldwide is asthma with hereditary transfer. It is typified by fluctuating airflow restriction, respiratory symptoms, variable airflow obstruction, causing episodic or persistent symptoms of wheezing, dyspnea, and cough.¹⁻³

Over the past sixty years, asthma has become much more common in developed nations.⁴ A rare number of 1:10 children have asthma symptoms, according to the Global Asthma Report 2022. Children have a greater average of yearly prevalence of asthma (9.5%) than adults (7.7%).⁵ Childhood asthma is characterized by a predominance of allergic sensitivities, while poly

sensitivity in adults is positively associated with the incidence of asthma.⁶ Allergic asthma is considered the most common asthma phenotype among other types. It is characterized by subsequent typical asthmatic symptoms after exposure to airborne allergens and IgE sensitization.^{7,8}

The individuals with allergic asthma have greater total IgE levels than nonallergic asthmatics, but these values mostly overlap.⁹ When combined with other biomarkers, serum IgE levels can be used to distinguish between those who have asthma and those who do not clearly. IgE levels in patients are associated with bronchial hyperresponsiveness and asthma severity.^{10, 11} In addition, an increase in serum IgE levels is linked to asthma and is thought to be a strong indicator of the onset of asthma.¹²

IgE is an antibody produced by B-cells after differentiation into plasma cells in lymph nodes. IgE represents the most levels of antibody classes and, even in trace doses, can cause severe inflammatory reactions in those patients. There is evidence that the IgE response can persist for years in the absence of allergen stimulation, even if its half-life is only a few days. Long-lived plasma cells that generate IgE are probably the culprit undergoing the disorder.^{13, 14}

The current study aimed to examine the total IgE levels in Iraqi asthmatic children and compare them in two different periods (2022 and 2026) to detect if allergic asthma had increased in recent years compared with the past.

Materials and Methods

The Design of Study

The study was designed as a cross-sectional type. The researchers recruited 122 children with asthma between January 25 and May 24, 2026, while 85 subjects were recruited from Iraqi Teaching Hospital for Children between June 2022 and October 2022. The patients ranged in age from (1 -16 years) on average.

The patients' recruitment

Based on a clinical evaluation, asthma was diagnosed for every child with asthma who met

the criteria set forth by the American Thoracic Society and the European Respiratory Society.¹⁵ The specialist pediatrician used the international criteria diagnosed in the NAEPP/EPR 3 Guidelines to determine the degree of asthma severity and well-controlled patients. The study's asthma patients had normal clinical histories of mild, moderate, or severe persistent asthma. A total serum IgE test was performed on each patient. Since many laboratories consider IgE levels > 100 kU/L to be elevated, a level of 100 units/mL was selected to distinguish between high and low IgE groups.¹⁶

Study Limitation

A significant constraint of this study is the variation in the periodic time tabling of contributor employment relating to the two study periods. Data collection was conducted from June to October 2022 (summer and autumn) and from January to May 2026 (winter and spring). Seasonal alterations in contact with airborne allergens, incorporating pollen, dust, and mold spores, as well as differences in respirational infections and environmental environments, may affect total serum IgE levels and asthma aggravations in children.

Collection of Samples and Processing

Each participant's serum was separated from whole blood to measure the total serum IgE levels using the Accu-Bind total IgE ELISA kit, USA (LOT NO. 25K1D1), and the Comb wash Max-Planck-Ring 21 automated immunoassay analyzer for humans (German origin).

Statistical Analysis

Data were processed into IBM SPSS Statistics Version 21 (San Diego, California, USA) for the purpose of statistical results analysis. Continuous variables were defined as mean standard deviation, whereas categorical variables were expressed as absolute numbers and percentages. Chi-square was used to compare two categorical variables, and a t-test was utilized to compare the two means. A *p*-value of less than 0.05 was deemed statistically significant; if the probability is less than 0.01, it is extremely significant.

Results

Demographic Data for Study Population: In the present study, 85 asthmatic children were collected in 2022 and 122 asthmatics in 2026. There was non-significant difference between age groups statistically, sex, and BMI (0.09, 0.79, 0.71, and 0.77, respectively) between the two groups of asthmatic children. The age of first

and second groups were 6.42 ± 3.736 , and 7.33 ± 3.79 years, respectively. Approximately, 69.4% of asthmatic children in 2022 were male, while 66.39% in 2026. On the other hand, 30.59% and 33.61% were female in 2022 and 2026, respectively. BMI was 17.53 ± 3.36 and 17.00 ± 2.45 (in 2022 and 2026, respectively), as shown in Table (1).

Table 1. Demographic characteristics of asthmatic children at two different years.

Demographic characteristics		Asthmatic children at 2022 N=85	Asthmatic children at 2026 N=122	p-value
Age (mean $\pm$ SD)		6.42 $\pm$ 3.736	7.33 $\pm$ 3.79	NS
Sex	Male, No. (%)	59 (69.4%)	81 (66.39%)	NS
	Female, No. (%)	26 (30.59%)	41 (33.61%)	NS
BMI (kg/cm ²), mean $\pm$ SD		17.53 $\pm$ 3.36	17.00 $\pm$ 2.45	NS

BMI: Body Mass Index. $p > 0.05$ is not significant (NS)

There is no significant difference in the number of asthmatic children between 2022 and 2026 compared with different risk factors, such as smoking, presence of animals in the house, history families to the asthmatic/allergic diseases, and living in urban versus rural areas (0.91, 0.93, 0.89, 0.94, 0.54, 0.14, 0.13, respectively). In contrast, there is a highly

significant statistical difference in the percentage of asthmatic children who live in rural areas between 2022 and 2026 ($p=0.006$). The percentage of asthmatic children in rural areas in 2026 is 32.79%, while in 2022, only 14% of asthmatic children lived in rural areas as in Table (2).

Table 2. Risk factors of asthmatic children at two different years.

Risk factors		Asthmatic children at 2022 N=85	Asthmatic children at 2026 N=122	p-value
Resident	Urban	73 (86%)	82 (67.21%)	NS
	Rural	12 (14%)	40 (32.79%)	0.006
Smoking	Yes	34 (40%)	50 (40.98%)	NS
	No	51 (60%)	72 (59.02)	NS
Animal in house	Yes	21 (24.71%)	32 (26.23%)	NS
	No	64 (75.29)	90 (73.77%)	NS
Family history of asthma/ allergic disease	Yes	76 (89.41%)	99 (81.15%)	NS
	No	9 (10.59%)	23 (18.85%)	NS

$p > 0.05$ is not significant (NS)

Table 3 shows that the degree of asthma severity in Iraqi children raised in 2026 compared with 2022. In 2026, the percentage of moderate score and severe asthma case was

45.08% and 13.93%, respectively, while in 2022, the percentage of moderate asthma was 34.12%, with no severe asthma in asthmatic children during the research period.

Table 3. Association asthma severity between two different years of asthmatic children.

Severity	Asthmatic children at 2022 N=85	Asthmatic children at 2026N=122	p-value
Mild	56 (65.88%)	48 (39.34%)	0.008
Moderate	29 (34.12%)	55 (45.08%)	0.002 ^b
Severe	0 (0%)	17 (13.93%)	

^a: four missing data at asthmatic children in 2022, ^b: Fisher's Exact Test. $p \leq 0.05$ is significant.

Table (4) shows that the total levels of IgE increased significantly in 2026 in children with asthma (297.55 ± 251.56 IU/ml), compared with asthmatic children in 2022 (224.71 ± 231.01 IU/ml), ($p=0.035$). In 2026, the number of

asthmatic children with a total IgE > 100 IU/ml was 70.49% of total asthmatic children, while in 2022, only 50.59% of asthmatic children with total levels of IgE > 100 IU/ml as in Table (5).

Table 4. Difference of Total serum IgE levels between two different years of asthmatic children.

Total IgE in serum (IU/ml)	Asthmatic children at 2022 N=85	Asthmatic children at 2026 N=122	p-value
Mean $\pm$ SD	224.71 $\pm$ 231.01	297.55 $\pm$ 251.56	0.035

$p \leq 0.05$ is significant.

Table 5. Association Total serum IgE groups between two different years of asthmatic children.

IgE groups	Asthmatic children at 2022 N=85	Asthmatic children at 2026 N=122	p-value
Low IgE <100 IU/mL	42 (49.41%)	36 (29.51%)	0.006
High IgE >100 IU/mL	43 (50.59%)	86 (70.49%)	
p-value	NS	<0.001	

$p > 0.05$ is not significant (NS)

Discussion

Asthma is a complex, heterogeneous respiratory disease influenced by genetic predisposition, immune mechanisms, and environmental exposures. Allergic asthma is commonly associated with IgE-mediated inflammation, although total serum IgE levels alone cannot reliably distinguish allergic from non-allergic asthma or fully characterize disease severity. Environmental contaminants and other external exposures may contribute to the development and exacerbation of asthma, highlighting the importance of considering environmental factors when interpreting changes in asthma-related biomarkers over time.^{4,17} In the present study, total serum IgE levels were significantly higher among asthmatic children recruited in

2026 than among those recruited in 2022 (297.55 ± 251.56 vs. 224.71 ± 231.01 IU/mL, respectively; $p = 0.035$). Furthermore, the proportion of children with total serum IgE levels above 100 IU/mL increased from 50.59% in 2022 to 70.49% in 2026 ($p = 0.006$). These findings indicate a difference in total serum IgE levels between the two study populations. However, elevated total IgE may reflect underlying atopy and other clinical conditions, and its interpretation should consider the patient's clinical characteristics and other relevant biomarkers.^{18,19} IgE plays an important role in allergic inflammation through its interaction with high-affinity receptors on mast cells and basophils. This interaction promotes the release of inflammatory mediators that contribute to mucus secretion, increased

vascular permeability, and airway hyperresponsiveness.²⁰ Increased IgE production in response to environmental allergens may contribute to the pathophysiology of allergic asthma, particularly in genetically predisposed individuals^[21]. IgE is involved in both early- and late-phase allergic responses, supporting its biological relevance in allergic airway inflammation.²² Nevertheless, markedly elevated total serum IgE is not specific to asthma and may occur in other atopic and immunological conditions.²³ Previous research has also demonstrated an association between total serum IgE and atopy in patients with asthma, although the strength and clinical significance of this association may vary across populations.^{24, 22} Therefore, the higher IgE levels observed in the 2026 group may reflect differences in allergic sensitization or other contributing factors; the present study cannot establish the underlying mechanisms responsible for this difference. The distribution of asthma severity also differed between the two study populations. In 2022, 65.88% of children had mild asthma and 34.12% had moderate asthma, with no severe cases recorded among the available observations. In contrast, the 2026 group included 39.34% with mild asthma, 45.08% with moderate asthma, and 13.93% with severe asthma. These findings suggest that the children recruited in 2026 had a greater proportion of moderate-to-severe asthma. However, the cross-sectional comparison does not establish that individual patients experienced worsening disease over time, nor does it demonstrate that increased IgE levels caused greater asthma severity. In addition, differences in treatment, adherence, disease control, and other clinical characteristics may have influenced the observed distribution. Although inflammatory mediators, including interleukin-6, have been investigated in respiratory diseases, the present study did not measure IL-6; therefore, its potential contribution to the observed differences cannot be determined from these data.²⁵

Regarding the other characteristics examined, smoking exposure, the presence of animals in the household, and family history of asthma or allergic disease did not show

statistically significant differences between the two study populations. However, the proportion of children residing in rural areas was significantly higher in 2026 than in 2022 (32.79% vs. 14.00%, respectively; $p = 0.006$). This difference may be relevant when interpreting the findings, as environmental exposures can vary according to residential setting. Nevertheless, the study did not directly quantify allergen exposure or environmental pollutants, and no causal relationship between residence and the observed IgE differences can be inferred.

An important limitation is the difference in the periods of data collection. Participants in 2022 were recruited between June and October, whereas those in 2026 were recruited between January and May. Seasonal variations in pollen exposure, airborne allergens, respiratory infections, and other environmental conditions may influence allergic inflammation and asthma exacerbations. Consequently, the observed differences in total serum IgE levels and asthma severity may partly reflect seasonal or environmental variation rather than a temporal change in the underlying disease pattern. Other limitations include the use of two separate cross-sectional samples, the absence of longitudinal follow-up, and the lack of adjustment for potential confounders. These factors should be considered when interpreting the findings and limit the generalizability of the results.

Overall, this study identified higher total serum IgE levels and a greater proportion of moderate-to-severe asthma among Iraqi children recruited in 2026 compared with those recruited in 2022. These findings provide a basis for further investigation of temporal differences in allergic biomarkers and asthma severity. Future studies using standardized recruitment periods, larger representative populations, longitudinal follow-up, and multivariable analyses are needed to determine whether these differences persist after accounting for seasonal variation and other potential confounding factors.

In conclusion, from 2022 to 2026 we found an increase in the total IgE levels in Iraqi asthmatic children that was accompanied by a

worsening of asthma. Further research integrating objective and quantitative measurements of the degree of asthma severity is required to validate these findings.

Author Contributions

BAA; conducted the practical part and recorded the results. HAA and ZNN contributed to data analysis and manuscript editing. All the researchers participate in the statistical analysis, manuscript writing, and concept development. All authors reviewed and approved the final draft of the article.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethical approval

According to the Helsinki Declaration of 1975, as amended in 2000 (available at <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles>). The ethical standards of the committee responsible for human experimentation (institutional or regional) were followed in this study. An IRB was obtained, and the project was authorized by the Research Ethics Committee of Al-Furat Al-Awsat Technical University (ATU)/ Iraq (2021-12-15).

Informed consent

Written informed consent and verbal explanations of the study's purpose were given to the parents of participants who indicated they were willing to participate, gathering and processing of samples.

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