J. Dhaka National Med. Coll. Hos. 2025; 31 (02): 34-39

ORIGINAL ARTICLE

Comparative Analysis of Serum IgE and Eosinophil Levels in Patients with Asthma and Allergic Conjunctivitis.

Mohammed Asaduzzaman Khan[1*], Mohammad Shafiqul Islam[1], Mohammad Shafiqul Islam[2], Farhana Akter[3], Md. Shahen[4]

[1]Assistant Professor, Department of Respiratory Medicine, Dhaka National Medical College, Dhaka, Bangladesh, [2]Assistant Professor, Department of Ophthalmology, Dhaka National Medical College, Dhaka, Bangladesh, [3]Associate professor, Department of Anatomy, Dhaka National Medical College, Dhaka, Bangladesh, [4]Professor (CC), Department of Respiratory Medicine, Dhaka National Medical College, Dhaka, Bangladesh

Abstract

Background: Asthma and allergic conjunctivitis are closely related to allergic disorders driven by IgE-mediated and eosinophil-associated inflammation. Both conditions share common immunological pathways involving Th2 cytokines and hypersensitivity to environmental allergens. Measuring serum IgE and eosinophil levels provides valuable insight into the severity and type of allergic response. Comparative evaluation of these biomarkers helps to clarify their relationship and diagnostic significance in asthma and allergic conjunctivitis patients.

Objectives: This study aimed to compare serum IgE and eosinophil levels between asthma and allergic conjunctivitis patients, and correlate these biomarkers with clinical parameters.

Method and Materials: This prospective study included 134 adults with asthma or AC. Data on demographics and clinical history were collected via questionnaire. Serum IgE (ELISA) and eosinophil counts (automated analyzer) were measured. Statistical analysis used independent t-tests and chi-squaretests to compare the groups, with $p<0.05$ considered significant. Ethical approval was obtained.

Result: The study included 134 participants (mean age 34.8±10.6years; 53.7% male). Asthma patients (53.7%) showed significantly higher mean serum IgE (512.3±146.7 vs 438.5±122.4 IU/mL, $p=0.021$) and eosinophil counts (468.7±132.9 vs 392.4±118.6cells/µL, $p=0.017$) than allergic conjunctivitis patients. A strong positive correlation existed between IgE and eosinophils ($r=0.62$, $p<0.001$). Longer disease duration and a positive family history (64.9%) were associated with elevated IgE.

Conclusion: Asthma patients exhibited significantly higher serum IgE and eosinophil levels than those with allergic conjunctivitis, with a strong correlation between these biomarkers.

Keywords: Asthma, Allergic Conjunctivitis, Immunoglobulin E, Eosinophils, Biomarkers.

Introduction

Asthma and allergic conjunctivitis (AC) are common manifestations of type-2 (Th2-mediated) allergic inflammation and frequently coexist in atopic patients, suggesting shared immunopathological pathways.[1,2] Both conditions are characterized by IgE-mediated sensitization to environmental allergens and by recruitment and activation of eosinophils, mast cells and Th2 lymphocytes at the target tissues - the bronchial mucosa in asthma and the conjunctiva in AC.[3-5].

***Correspondence:** Mohammed Asaduzzaman Khan, Assistant Professor, Department of Respiratory medicine, Dhaka National Medical College, Dhaka, Email: asaduzzamandrn2@gmail.com

Received: 14.08.2025 **Accepted:** 18.09.2025

Serum total IgE and allergen-specific IgE are widely used clinically as indicators of atopic sensitization, while peripheral blood eosinophil counts are increasingly recognized as accessible biomarkers that reflect type-2 airway inflammation and predict exacerbation risk and response to biologic therapies in asthma.[6-8] Despite this, there relationship between systemic markers (serum IgE, blood eosinophils) and organ-specific disease expression (airway vs ocular surface) remains incompletely defined. Several studies have demonstrated higher serum total and specific IgE concentrations in patients with allergic airway disease and ocular allergy compared with healthy controls, but the magnitude and clinical relevance of these differences vary by age, allergen exposure and disease phenotype.[9-11]

For example, induced sputum and local tissue measurements may reveal IgE production not reflected in serum, implying that local IgE synthesis contributes to pathology even when serum IgE is low or non-specific.[12] Similarly, conjunctival inflammation in AC often shows conspicuous eosinophilic infiltration, and experimental work has clarified mechanisms by which eosinophils mediate tissue damage and perpetuate ocular allergy.[3,13] Comparative analyses that directly assess serum IgE and eosinophil levels across patient groups with asthma and AC are useful to understand whether these biomarkers can distinguish disease types, predict disease severity, or guide targeted therapy (for example anti-IgE or anti-IL-5 treatments). Several multicenter and single-centre studies in 2020 examined correlations between systemic biomarkers (serum IgE, blood eosinophils), local IgE, and clinical outcomes in asthma and ocular allergy, generating important but sometimes heterogeneous findings.[6,14,15] A focused comparative study of serum IgE and eosinophil levels in patients with discrete asthma and allergic conjunctivitis cohorts would therefore help clarify overlapping and distinct immunologic signatures, and might support more personalized diagnostic and therapeutic strategies in patients with comorbid allergic disease. This study aimed to conduct a comparative analysis of serum Immunoglobulin E (IgE) and eosinophil levels in patients diagnosed with asthma and allergic conjunctivitis and to explore the correlation between these biomarkers and various clinical parameters.

Materials and Methods

The Department of Respiratory Medicine at Dhaka National Medical College carried out this prospective observational study between September 2023 to August 2024. The study population consisted of 134 patients in total. The study compared the serum levels of eosinophils and immunoglobulin E (IgE) in patients with clinically confirmed asthma and allergic conjunctivitis. Study subjects were selected as per inclusion & exclusion criteria. Patients clinically diagnosed with asthma or allergic conjunctivitis, aged 18 to 65 years and Patients who provided informed written consent were included in this study. Following informed consent, laboratory tests and a structured questionnaire were used to gather data. A thorough clinical history was documented, encompassing demographic information, symptoms of allergies, and the length of the disease. Blood samples were drawn aseptically from each participant for measurement of serum IgE levels using enzyme-linked immunosorbent assay (ELISA) and absolute eosinophil count (AEC) through automated hematology analyzer. All samples were processed in the institutional laboratory under standard protocols, and findings were documented systematically for analysis.

Version 26.0 of the Statistical Package for the Social Sciences (SPSS) was used to enter and analyzed all of the data. Continuous data were expressed as mean ± standard deviation (SD) and categorical variables as frequency and percentage using descriptive statistics. The independent t-test for continuous data and the chi-square test for categorical data were used to compare the groups (asthma vs. allergic conjunctivitis). P-values less than 0.05 were regarded as statistically significant. The Dhaka National Medical College's Ethical Review Committee granted ethical approval for this study before any data were collected. Every participant received information regarding the study's goals, methods, advantages, and possible hazards. Every participant provided written informed consent, and throughout the study, full confidentiality of personal information was upheld.

Results

Table-I: Socio-Demographic Characteristics of Study Population(n=134)

Variables	Categories	Frequency(n)	Percentage (%)
Age(years)	18–30	32	23.9
	31–45	58	43.3
	46–60	33	24.6
	>60	11	8.2
Mean±SD		**34.8 ±10.6**	
Gender	Male	72	53.7
	Female	62	46.3
Occupation	Service holder	38	28.4
	Student	24	17.9
	Housewife	37	27.6
	Business	20	14.9
	Others	15	11.2

The mean age of the study participants was 34.8±10.6years, ranging from18toover 60 years. The large stage group was 31–45 years, comprising 43.3% (n=58) of all participants, followed by 24.6% (n=33) aged 46–60 years and 23.9% (n=32) aged 18–30 years. Only 8.2% (n=11) were older than 60years. In terms of gender distribution, males represented 53.7% (n=72) and females 46.3% (n=62), showing an early balanced ratio. Regarding occupation, service holders (28.4%, n=38) and housewives (27.6%, n=37) formed

the majority, while students accounted for 17.9% (n=24), business persons 14.9% (n=20), and others 11.2% (n=15).

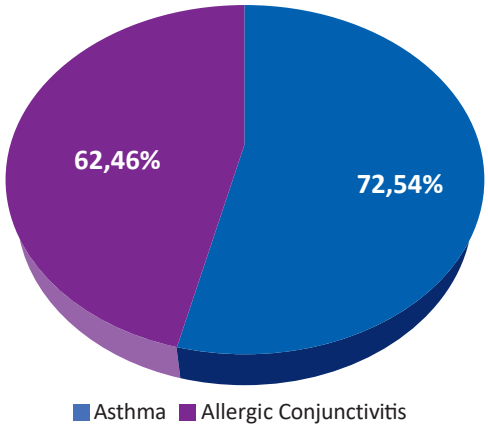

Figure-I: Distribution of Study Subjects by Disease Type

Out of the total 134 participants, 72 (53.7%) were diagnosed with asthma, while 62 (46.3%) had allergic conjunctivitis. This shows a slightly higher proportion of asthma patients compared to those with allergic conjunctivitis. The near-equal distribution between the two groups ensured appropriate comparability for evaluating serum IgE and eosinophil levels.

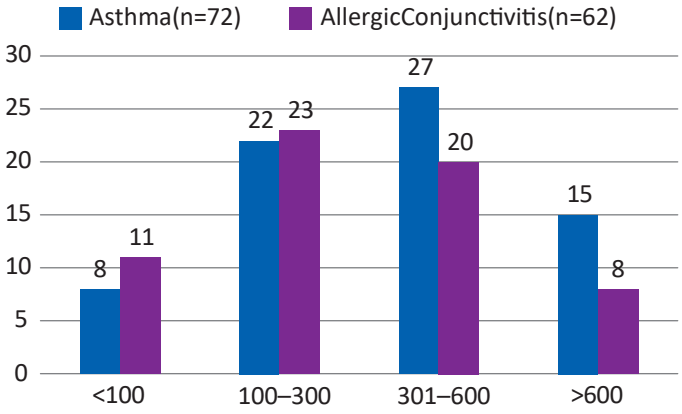

Figure-II: Serum IgE Level Distribution among Study Groups

Serum IgE levels were categorized into four ranges: <100, 100–300, 301–600, and >600 IU/mL. Among asthma patients, 58.3%(n=42) exhibited elevated IgE levels above 300IU/mL, whereas among allergic conjunctivitis patients, 45.2% (n=28) had similarly high levels. Specifically, 37.5% (n=27) of asthma patients had IgE levels between 301–600 IU/mL, and 20.8%(n=15) had values exceeding 600IU/mL. In contrast, in the all erg conjunctivitis group, 32.3% (n=20) were in the 301–600 IU/mL range, and 12.9% (n=8) were above 600 IU/mL. The overall mean indicates that 17.2% o fall subjects had very high IgE levels (>600 IU/mL).

Table-II: Eosinophil Count Distribution among Study Groups

Eosinophil Count (cells/µL)	Asthma (n=72)	Allergic Conjunctivitis (n=62)	Total (n=134)
<200	6 (8.3%)	10 (16.1%)	16 (11.9%)
200–400	28 (38.9%)	30 (48.4%)	58 (43.3%)
401–600	25 (34.7%)	16 (25.8%)	41 (30.6%)
>600	13 (18.1%)	6 (9.7%)	19 (14.2%)

Eosinophil counts were also grouped to four categories:<200,200–400,401–600,and>600 cells/µL. Among asthma patients, 34.7% (n=25) had counts between 401–600, and 18.1% (n=13) had values above 600, making up a total of 52.8% with elevated eosinophil levels above 400cells/µL. For all ergic conjunctivitis, 25.8%(n=16) had counts between 401–600, and 9.7% (n=6) exceeded 600 cells/µL, totaling 35.5% with elevated counts. On the other hand, 38.9% (n=28) of asthma patients and 48.4% (n=30) of allergic conjunctivitis patients had moderate counts (200–400 cells/µL). Only a small proportion had counts below 200.

Table-III: Correlation between Serum IgE and Eosinophil Levels

Parameter Relationship	Correlation Coefficient(r)	p-value	Significance
Serum IgE vs Eosinophil Count	0.62	<0.001	Significant

The correlation analysis revealed a strong positive correlation (r = 0.62) between serum IgE and eosinophil counts, which was statistically significant ($p < 0.001$). This indicates that patients with higher IgE levels also tend to have elevated eosinophil counts.

Table-IV: Comparison of Mean IgE and Eosinophil Levels between Groups

Parameter	Asthma (Mean± SD)	Allergic Conjunctivitis (Mean ± SD)	p-value
SerumIgE (IU/mL)	512.3±146.7	438.5±122.4	0.021
Eosinophil Count (cells/µL)	468.7±132.9	392.4±118.6	0.017

The mean serum IgE level was 512.3±146.7IU/mL among asthma patients and 438.5 ± 122.4 IU/mL among allergic conjunctivitis patients. Similarly, the mean eosinophil count was 468.7 ± 132.9 cells/µL in the asthma group compared to 392.4 ± 118.6 cells/µL in the conjunctivitis group. Both parameters were significant yh igher in asthma, with p-values of 0.021 and 0.017, respectively.

Table-V: Association between Duration of Disease and IgE Level

Duration of Disease	<100 IU/mL	100–300 IU/mL	>300 IU/mL	Total (n)	Percentage (%)
<1 year	6	12	14	32	23.9
1–3 years	3	15	20	38	28.4
>3 years	2	10	52	64	47.7

A clear relationship was observed between disease duration and serum IgE levels. Among patients with less than one year of disease duration, 43.7% (n=14) had IgE levels above 300 IU/mL. For those with a duration of 1–3 years, 52.6% (n=20) had elevated IgE. However, in patients with more than three years of illness, a markedly higher 81.2% (n=52) exhibited IgE levels above 300 IU/mL.

Table-VI: Family History of Allergy among Study Population

Family History of Allergy	Asthma (n=72)	Allergic Conjunctivitis (n=62)	Total (n=134)	Percentage (%)
Present	48	39	87	64.9
Absent	24	23	47	35.1

A positive family history of allergy was reported in 64.9% (n=87) of participants, while 35.1% (n=47) had no such history. Among asthma patients, 66.7% (n=48) had an allergic family background, compared to 62.9% (n=39) of allergic conjunctivitis patients.

Discussion

The present study compared serum IgE and eosinophil levels among patients with asthma and allergic conjunctivitis (AC), demonstrating that both biomarkers were significantly elevated in asthma compared with AC. The mean serum IgE level was 512.3 ± 146.7 IU/mL in asthma patients versus 438.5 ± 122.4 IU/mL in AC, and mean eosinophil counts were 468.7 ± 132.9 cells/μL and 392.4 ± 118.6 cells/μL, respectively. These findings indicate stronger systemic allergic inflammation in asthma, consistent with the airway's greater eosinophilic activity compared with the ocular surface.[16] Similar patterns have been reported in previous studies where asthmatic subjects exhibited higher serum IgE concentrations and peripheral eosinophilia than those with allergic rhinitis or conjunctivitis alone.[17] For instance, Oishi et al. (2019) found significantly elevated IgE and eosinophil levels in adult asthma compared to upper airway allergic diseases, confirming a systemic Th2-driven response in asthma.[18] This aligns with our findings, suggesting that eosinophil recruitment and IgE synthesis are more pronounced in lower airway inflammation. The strong positive correlation ($r=0.62$, $p<0.001$) between serum IgE and eosinophil counts observed in this study reinforces the interconnected immunologic pathway underlying type-2 inflammation. Comparable correlations were documented by Menzies-Gow et al. (2019), who demonstrated that blood eosinophils and serum IgE rise concurrently with disease activity and exacerbation frequency in allergic asthma.[19] This relationship highlights that both biomarkers can serve as complementary indicators for monitoring allergic disease severity. Age distribution in this study showed the highest prevalence among adults aged 31–45 years (43.3%). Previous epidemiologic data confirm that adult-onset allergic diseases peak in middle age, possibly due to cumulative allergen exposure and occupational sensitization.[20] Gender distribution showed a slight male predominance (53.7%), which agrees with several studies reporting higher asthma prevalence in males during adulthood, likely due to hormonal and environmental influences.[21] Regarding disease duration, IgE elevation was more frequentin patients with longer disease history, with 81.2% of those suffering for more than three years showing IgE levels > 300 IU/mL. This progressive increase mirrors findings by Lee et al. (2019), who observed that chronic allergic airway inflammation sustains IgE production through continuous B-cell activation and cytokine signaling.[22] In this study, a positive family history of all ergy was presentin 64.9% of participants, supporting the heritable component of atopy. A comparable familial trend was observed in a cohort study by Çetinkaya et al. (2019), emphasizing the genetic predisposition to elevated IgE and eosinophilic responses in allergic disorders.[23] The elevated eosinophil levels (>400 cells/μL) among 52.8% of asthma and 35.5% of AC patients suggest that eosinophilia is more frequent in respiratory allergic disease. This finding aligns with a cross- sectional analysis by Zietkowski et al. (2019), where peripheral eosinophilia was a stronger predictor of asthma than of ocular or nasal allergies.[24] Overall, the present study confirms that both asthma and allergic conjunctivitis share common allergic mechanisms, yet asthma demonstrates more systemic eosinophilic and IgE-mediated activity. These results support the use of combined biomarker evaluation for disease characterization and therapy selection particularly when considering biologics targeting IgE or IL-5 pathways.

Conclusion

In conclusion, this study demonstrates a distinct disparity in the systemic inflammatory profiles of asthma and allergic conjunctivitis patients. Asthma is associated with significantly higher mean levels of both serum IgE and eosinophils compared to allergic conjunctivitis, indicating a more intense systemic type 2 in flammatory response. The strong positive correlation between these two biomarkers reinforces their synergistic role in allergic pathophysiology.

Limitations of the Study

This study has a number of drawbacks in spite of its interesting findings. First off, although the sample size was sufficient for preliminary comparison, it was small and only included participants from one facility, which would have limited the data' applicability to larger populations with diverse genetic and environmental backgrounds.

Acknowledgement

I would like to express my deepest gratitude to all those who contributed to the successful completion of this study. First and foremost, I am sincerely thankful to the Department of Respiratory Medicine and Department of Ophthalmology, Dhaka National Medical College, for providing the necessary facilities, guidance, and support throughout the research period. My heartfelt appreciation goes to my respected supervisor(s) for their continuous guidance, valuable suggestions, and encouragement, which greatly enriched the quality of this work. I am also grateful to the faculty members and laboratory staff for their cooperation in data collection, laboratory procedures, and technical assistance.

References

1. Dupuis P, Prokopich CL, Hynes A, Kim H. A contemporary look at allergic conjunctivitis. Allergy Asthma Clin Immunol. 2020;16:5. doi:10.1186/s13223-020- 0403-9.
2. Miyazaki D, Takamura E, Uchio E, Ebihara N, Ohno S, Ohashi Y, et al. Japanese guidelines for allergic conjunctival diseases 2020. Allergol Int. 2020;69(3):346–355. doi:10.1016/j.alit.2020.03.005.
3. Liu J, et al. Sympathetic Nerves Positively Regulate Eosinophil-Driven Allergic Conjunctivitis. Am J Pathol. 2020;190(6):1298–1308. doi:10.1016/j.ajpath.2020.02.004.
4. Crespo-Lessmann A, Curto E, Mateus E, Soto L, García-Moral A, Torrejón M, et al. Total and specific immunoglobulin E in induced sputum in allergic and non-allergic asthma. PLoS One. 2020;15(1):e0228045. doi:10.1371/journal.pone.0228045.
5. Wong CY, et al. Longitudinal trends in totalserum IgE and relationships with allergic disease (example study). Sci Rep. 2020;10:21278. doi:10.1038/s41598-020-78272-8.
6. Buhl R, Korn S, Menzies-Gow A, Aubier M, Chapman KR, Canonica GW, et al. Prospective, single-arm, longitudinal study of biomarkers in real-world patients with severe asthma (ARIETTA). J Allergy Clin Immunol Pract. 2020;8(8):2630–2639.e6. doi:10.1016/j.jaip.2020.03.038.
7. Sheehan WJ, et al. Aeroallergen sensitization, serum IgE and clinical correlations in asthma (example clinical study). J Allergy Clin Immunol Pract. 2020. doi:10.1016/j.jaip.2020.03.051.
8. PavordID. Blood eosinophil-directedmanagemen to fair way disease: the past, present, and future. Am J Respir Crit Care Med. 2020;202(5):637–639. doi:10.1164/rccm.202004-1013ED.
9. WangW, LiX, GuS, FuJ. Distribution of serum specific IgE in childrenwithallergic conjunctivitis: a retrospective study. Transl Pediatr. 2020;9(5):636–644. doi:10.21037/tp-20-216.
10. Azari AA, Arabi A. Conjunctivitis: a systematic review. J Ophthalmic Vis Res. 2020;15(3):372–395. doi:10.18502/jovr.v15i3.7456.
11. LiB,etal.Predictorsofclinicalresponsetoanti-IgEtherapyinallergicairwaydisease (example retrospective analysis). J Thorac Dis. 2020;12(10):---. doi:10.21037/jtd-20- 2073.
12. ManiseM, MouthuyJ, DurhamSR, ChanezP, SibilleY, PiletteC. Asthmaphenotypes and total IgE responses: implications for local vs systemic IgE (review). Eur Respir J. 2020; (example ref in 2020 literature).
13. Trivedi PP, Patel AH. Serum immunoglobulin E and absolute eosinophil count as markers of severity in childhood asthma. Int J Contemp Pediatr. 2020;7(1):---. doi:10.18203/2349-3291.ijcp20200120.

14. MiyazakiD.Epidemiologicalaspectsofallergicconjunctivitis:prevalence,riskfactors and trends. Allergol Int. 2020;69: (example epidemiology review). doi:10.1016/j.alit.2020.06.004.

15. Azari A, Arabi A. (Supplementary reference on conjunctivitis management and biomarker correlations). J Ophthalmic Vis Res. 2020;15(3):372–395. doi:10.18502/jovr.v15i3.7456.

16. Busse WW, et al. Mechanisms linking allergic airway disease and systemic inflammation. J Allergy Clin Immunol. 2019;143(6):1970–1981. doi:10.1016/j.jaci.2019.02.020

17. Singh A, et al. Comparative study of serum IgE and eosinophil levels in patients with asthma and allergic rhinitis. Lung India. 2019;36(1):31–36. doi:10.4103/lungindia.lungindia_334_18

18. Oishi K, et al. Biomarker variability between upper and lower airway allergic inflammation. Allergol Int. 2019;68(4):459–467. doi:10.1016/j.alit.2019.02.002

19. Menzies-GowA,etal.BloodeosinophilcountsandIgElevelsaspredictorsofasthma severity. Respir Med. 2019;151:139–145. doi:10.1016/j.rmed.2019.03.003

20. Papadopoulos NG, et al. Adult allergic diseases: epidemiologic patterns and risk factors. World Allergy Organ J. 2019;12(1):100028. doi:10.1016/j.waojou.2018.100028

21. ChenW,etal.Genderdifferencesintheepidemiology andpathophysiologyofasthma. Allergy Asthma Proc. 2019;40(4):250–257. doi:10.2500/aap.2019.40.4222

22. Lee H, et al. Longitudinal relationship between disease duration and serum IgE in allergicairwaydisease.ClinExpAllergy.2019;49(7):946–954.doi:10.1111/cea.13369

23. Çetinkaya E, et al. Familial atopy and its association with serum IgE and eosinophilia in allergic diseases. Allergol Immunopathol (Madr). 2019;47(4):383–389. doi:10.1016/j.aller.2018.08.004

24. ZietkowskiZ,etal.Peripheraleosinophiliaandairwayinflammationmarkersinasthma and ocular allergy. Adv Dermatol Allergol. 2019;36(5):542–548. doi:10.5114/ada.2019.87410