

The Relationship Between Total IgE, Symptom Duration, VAS Scores, and Danyoung Classification in Allergic Rhinitis

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Manuscript received: 14 August, 2025. Revision accepted: 03 October, 2025. Published: 28 October, 2025.

Abstract

Allergic Rhinitis (AR) is an inflammatory condition of the nasal mucosa triggered by allergies, with total IgE often used as a biomarker to assess disease severity. Objective: To analyze the relationship between total IgE levels, symptom duration, Visual Analog Scale (VAS) scores, and Danyoung Classification in AR patients. Methods: A cross-sectional observational analytical study was conducted on 73 patients at the Allergy-Immunology Clinic of Dr. Saiful Anwar General Hospital. Total IgE levels were measured using the ELISA method, while VAS and nasal mucosa classification were assessed through anamnesis and nasoendoscopy. Results: The study showed 68.5% of patients had IgE levels above 100 IU/ml, with an average of 982.97 IU/ml. Although higher IgE levels were often found in AR patients, there was no statistically significant correlation between IgE levels and Danyoung classification (significance value 0.924). The correlation test showed a coefficient of -0.11, indicating a negative correlation, but it was not statistically significant. Conclusion: The nasal mucosa condition in patients with high IgE levels does not always reflect severe inflammation. In addition to IgE levels, external factors such as exposure to pollutants and cigarette smoke also play a role in the condition of the nasal mucosa. Therefore, while high IgE levels often indicate allergic reactions, this study found no significant relationship between IgE levels and AR severity.

Keywords: Allergic rhinitis; Danyoung classification; total IgE; symptom duration; VAS score.

INTRODUCTION

Allergic Rhinitis (AR) is an atopic disease characterized by hypersensitivity reactions in the nasal mucosa mediated by Immunoglobulin E (IgE), triggered by exposure to one or more allergens such as dust, pollen, or pet dander. Symptoms include sneezing, nasal congestion, itching, and clear watery rhinorrhea, which often impacts the quality of life of patients (Bousquet et al., 2020; Small et al., 2018). AR is a global health issue affecting 10-20% of the population. It typically begins after age 2, but the prevalence in early life is not well known, affecting 10-30% of the population, particularly in children and adolescents (Öçal et al., 2019). The duration and severity of symptoms vary among individuals, depending on allergen exposure and the immune response.

Total IgE is often used as an initial indicator to detect the presence of allergic diseases or other immunological conditions. IgE is produced by B cells (B lymphocytes) as part of the adaptive immune system and triggers allergic reactions by activating of mast cells and basophils. IgE plays a crucial role in the immune response to allergens and parasitic infections. Elevated

levels of total IgE in serum are frequently associated with the severity of allergic reactions and underlying allergic diseases, including AR (Bousquet et al., 2015; de Paula Couto et al., 2014).

Clinical evaluation of AR requires both subjective and objective measurements. The Visual Analog Scale (VAS) assesses patients' subjective perception of symptom intensity, such as nasal congestion, sneezing, itching, or rhinorrhea. The use of VAS in AR is considered a valid, simple, and reliable method for measuring the clinical impact of AR (Small et al., 2018). In his research, Chang classified the nasal mucosa surface through nasoendoscopy in AR patients based on age and sex over 10-years, finding three stages of change in the nasal mucosa of allergic rhinitis patients. Stage 1 is hypertrophy of the turbinates (hypertrophy condition). Stage 2 is when the turbinates appear concave (concave condition). Stage 3 shows the turbinates appearing wrinkled (wrinkled condition). This study revealed a linear regression relationship between age and disease stage. This classification is known as the Danyoung Classification (Chang, 2015, 2018).

MATERIALS AND METHODS

This analytical observational study with a cross-sectional approach was conducted from January 2023 to August 2024, involving 73 patients at the Allergy-Immunology clinic, Department of Otorhinolaryngology, Head and Neck Surgery, Dr. Saiful Anwar Hospital, who met the inclusion criteria. 73 patients with allergic rhinitis underwent VAS score assessment, total IgE testing, and evaluation of the nasal mucosa structure using nasoendoscopy to determine Danyoung classification.

Total IgE measurement was conducted through blood sampling using the ELISA (Enzyme-Linked Immunosorbent Assay) method or other serological techniques available at the Dr. Saiful Anwar Hospital laboratory. The duration of symptoms was measured based on the patient's history regarding the length of time symptoms were experienced, noted in days or weeks. Patients rated the intensity of their allergic rhinitis symptoms on a VAS scale from 0 to 10, where 0 indicated no symptoms and 10 indicated very severe symptoms. Danyoung classification, based on nasal mucosa assessment, was performed using nasoendoscopy by an otorhinolaryngology specialist, who classified patients into three stages of mucosal change.

This study analyzes the relationship between total IgE levels and symptom duration, VAS scores, and Danyoung classification in patients with allergic rhinitis. Collected data will be analyzed using statistical software. Descriptive analysis will be conducted to describe the demographic characteristics of the sample (age, gender) and the distribution of total IgE levels, symptom duration, VAS scores, and stages of Danyoung classification. Pearson or Spearman correlation tests will assess the relationship between total IgE and Danyoung classification. Pearson's test will be used if the data is normally distributed, while Spearman's test will be employed if the data is not normally distributed.

RESULTS AND DISCUSSION

Based on gender distribution, the patients with allergic rhinitis who visited the ENT-Head and Neck clinic included 35 males (47.9%) and 38 females (52.1%). The analysis of gender data indicates that there is no significant difference between the number of males and females suffering from allergic rhinitis (AR). The underlying mechanism for this occurrence may involve the role of estrogen. Estrogen has a significant effect on several components of the immune system. It potentially influences every stage of allergic sensitization, including antigen presentation, Th2 polarization, IgE production, and mast cell degranulation via classical estrogen receptors. Studies using animal models indicate that estrogen can trigger the production of IL-5 and IL-13 from the mediastinal lymph nodes and stimulate

eosinophil cells in peripheral blood (Bonds & Midoro-Horiuti, 2013; Weare-Regales et al., 2022).

Based on the VAS distribution data, the most common VAS score was VAS 2, with 38 patients (52.1%), followed by VAS 5 with 7 patients (9.6%), and VAS 7 and VAS 6, each with 6 patients. In terms of symptom duration, 56 patients (76.7%) reported symptoms lasting over 12 months, followed by 12 patients (16.4%) with symptoms lasting 6–12 months, and 5 patients (6.8%) with symptoms lasting less than 6 months. These chronic complaints and activity disturbances often lead patients to seek help from an ENT specialist after experiencing symptoms for more than 12 months, as previous treatments have not provided improvement. Despite their persistence, some patients reported that they had become accustomed to their allergic rhinitis symptoms and considered them not overly bothersome. Patients who had undergone effective therapies, such as antihistamines or corticosteroid nasal sprays, could manage their symptoms well. Good allergy control can lead to reduced symptom intensity, resulting in lower VAS scores, which may explain why some patients rated their symptoms lower on the VAS (Doulaptsi et al., 2018; Klimek et al., 2017). Currently, the classification of allergic rhinitis (AR) is based on ARIA 2008, which divides AR into intermittent (if symptoms last less than 4 days per week or less than 4 weeks) and persistent (if symptoms last more than 4 days per week and more than 4 weeks) (Bousquet et al., 2020). Allergic rhinitis is not only diagnosed by ENT specialists but is also frequently encountered by general practitioners. Common symptoms of allergic rhinitis include nasal congestion, rhinorrhea, itching in the nose, and/or sneezing. The presence of two or more symptoms lasting for more than one hour per day can be classified as suspected allergic rhinitis. The therapy often provided is merely symptomatic treatment, such as decongestants and oral antihistamines, but the gold standard examination to determine the type of allergy is often not performed (Sharma et al., 2022). As a result, patients frequently remain exposed to allergens, preventing complete resolution of their complaints. Severity is classified as mild if there are no disturbances to sleep, learning, work, or other activities, and moderate to severe if there is one or more disturbances (Bousquet et al., 2020; Sharma et al., 2022).

Based on the Danyoung Classification, stage 1 included 52 patients (71.2%), stage 2 included 16 patients (21.9%), and stage 3 included 5 patients (6.8%), with a p-value of 0.85. Meanwhile, Danyoung's classifications of stages 1 and 2 showed mild persistent symptoms in 50% and 40.9% of cases, respectively, while stage 3 showed moderate to severe persistent symptoms in 50.6% (p-value = 0.96). Zachreini stated that the histopathological features caused by allergies include thickening of the basement membrane, increased goblet cell count, elevated eosinophil numbers,

congested and dilated blood vessels, and stromal tissue edema. Repeated allergen exposure releases histamine, which stimulates the nasal mucosa, causing mucosal thickening and blood vessel dilation, especially in the cavernous plexus of the turbinates. The structure of the mucosal epithelial layer changes to stratified cuboidal, the cilia disappear, and the number of goblet cells increases. The submucosal layer experiences edema, infiltration by plasma cells, round cells, and fibroblasts, while the cavernous plexus of the turbinates becomes enlarged, and smooth muscle atrophies (Zachreini et al., 2015). Prolonged exposure, type of allergens, and other risk factors can influence nasal mucosal inflammation. Patients who receive treatment, especially when symptoms first appear, and good hygiene are factors that can prevent recurrent inflammation of the nasal mucosa and reduce the atrophy process of smooth muscles in the inferior turbinate mucosa.

Based on the distribution data of Total IgE, the majority of patients had IgE levels above 100 IU/ml, with 50 patients (68.5%), and below 100 IU/ml, with 23 patients (31.5%). Elevated IgE levels are often associated with allergic responses, and the average Total IgE level in this study was 982.97 IU/ml. This suggests that the majority of allergic rhinitis patients in this study had relatively high IgE levels. However, this study did not find a statistically significant relationship between increased IgE levels and the classification of allergic rhinitis. Therefore, even though higher Total IgE levels are commonly observed in AR patients, these findings are insufficient to conclude a strong or significant correlation between elevated IgE and the severity of allergic rhinitis symptoms (de Paula Couto et al., 2014).

The correlation test results between Total IgE and Danyong Classification scores showed a significance value of 0.924 and a correlation coefficient of -0.11. Based on these results, it can be concluded that the value is above the 0.05 threshold, indicating that the correlation results are not statistically significant. The correlation coefficient -0.11 indicates a negative correlation. The study results show no significant relationship between Total IgE levels and Danyong Classification scores. IgE levels are not correlated with changes in Danyong Classification in allergic rhinitis patients within the analyzed data. High IgE levels indicate that the patient is experiencing an allergic reaction, which triggers the release many inflammatory mediators, including histamine, leukotrienes, and other cytokines. The release of these mediators causes chronic inflammation in the nasal mucosa, which can lead to turbinate hypertrophy. The condition of the nasal mucosa is not only determined by IgE levels but also by external factors such as exposure to pollutants, cigarette smoke, and infections. These factors can affect the nasal mucosa independently of IgE levels, so high IgE levels do not always cause mucosal inflammation. The immune response in allergies is mediated by various immune cells and molecules such as mast cells, basophils, and cytokines. Even though IgE

levels are high, the body's inflammation control mechanisms, including the activity of anti-inflammatory factors, can limit the severity of local inflammation in the nasal mucosa (Hyun et al., 2018).

CONCLUSIONS

The conclusion of this study is that, although elevated Total IgE levels were found in most allergic rhinitis patients, there was no significant correlation between IgE levels and the Danyong classification, which assesses nasal mucosal conditions in allergic rhinitis patients. The correlation results indicate that increased IgE levels do not correspond to changes in nasal mucosal structure based on the Danyong classification. Additionally, the nasal mucosal condition in allergic rhinitis patients is influenced not only by IgE levels but also by external factors such as exposure to pollutants, cigarette smoke, and infections, which independently contribute to mucosal inflammation. Although high IgE levels often indicate a strong allergic response, the body's mechanisms for controlling inflammation, including the activity of anti-inflammatory factors, can reduce the severity of local mucosal inflammation. Thus, Total IgE levels alone cannot be a sole indicator for assessing the severity of symptoms and mucosal inflammation in allergic rhinitis patients.

Authors' Contributions: A.T.W. conceptualized the study, recruited participants, collected clinical data, and performed clinical assessments including Danyong classification and VAS scoring. T.A. conducted data analysis and contributed to the study design. Both authors interpreted the findings, drafted and revised the manuscript, and approved the final version.

Competing Interests: The authors have no conflicts of interest to disclose.

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