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Evaluation of Eosinophil Indices in Pediatric Patients with Cow's Milk Allergy

İnek Sütü Alerjisi Olan Pediyatrik Hastalarda Eozinofil İndekslerinin Değerlendirilmesi

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Abstract

Objective: This study aimed to evaluate eosinophil indices and other inflammatory parameters in pediatric patients with cow's milk allergy (CMA), which are easily accessible and may be useful in predicting CMA.

Method: This retrospective study included 39 people in the patient group and 123 people in the control group. The records of the patients diagnosed with CMA by specific immunoglobulin E (IgE) tests were compared with patients without CMA. The study examined demographic data of the patients, including age at presentation and gender, as well as laboratory findings. The study included children under 24 months of age who underwent a specific IgE test for CMA and had simultaneous hemogram results.

Results: Neutrophil-to-eosinophil ratio (NER), derived neutrophil-to-lymphocyte ratio (dNLR), and leukocyte-to-eosinophil ratio (LER) were significantly lower in the CMA than control groups. On the other hand, eosinophil, eosinophil-to-monocyte ratio (EMR), and eosinophil-to-lymphocyte ratio (ELR) were significantly higher than control groups. Specific IgE levels were observed to have a negative correlation with LER, NER, and dNLR, and a positive correlation with eosinophil, EMR, and ELR. For a LER ≤22.2 cut-off value, sensitivity was 64.1%, and specificity was 73.2%.

Conclusion: In our study, LER and EMR seem to be useful parameters to predict CMA in children. This study's findings may indicate that leukocytes and eosinophils, could be crucial in the pathogenesis of CMA cases. Eosinophil counts and eosinophil indices, readily obtainable through a complete blood count, can serve as parameters for distinguishing CMA.

Keywords: Child, cow's milk allergy, eosinophil, eosinophil-to-monocyte ratio, leukocyte-to-eosinophil ratio

Öz

Amaç: Bu çalışmada, inek sütü alerjisi olan çocuk hastalarda, kolay erişilebilen ve inek sütü alerjisini öngörmede yararlı olabilecek eozinofil indeksleri ve diğer enflamatuvar parametrelerin değerlendirilmesi amaçlanmıştır.

Yöntem: Bu retrospektif çalışmaya hasta grubunda 39 kişi, kontrol grubunda ise 123 kişi dahil edilmiştir. Spesifik immünoglobulin E (IgE) testleri ile inek sütü alerjisi tanısı alan hastaların kayıtları, inek sütü alerjisi olmayan çocuklarla karşılaştırılmıştır. Çalışmada hastaların başvuru yaşı, cinsiyeti ve laboratuvar bulguları dahil olmak üzere demografik verileri incelenmiştir. Çalışmaya inek sütü alerjisi için spesifik IgE testi yapılan ve eş zamanlı hemogram sonuçları bulunan 24 aydan küçük çocuklar dahil edilmiştir.

Bulgular: Nötrofil-eozinofil oranı (NER), türetilmiş nötrofil-lenfosit oranı (dNLR) ve lökosit-eozinofil oranı (LER) inek sütü alerjisi olanlarda kontrol grubuna göre anlamlı derecede düşüktü. Diğer yandan, eozinofil, eozinofil-monosit oranı (EMR) ve eozinofil-lenfosit oranı (ELR) ise kontrol grubundan anlamlı derecede yüksekti. Spesifik IgE düzeylerinin LER, NER ve dNLR ile negatif korelasyon gösterdiği; eozinofil, EMR ve ELR ile pozitif korelasyon gösterdiği görülmüştür. LER ≤22,2 kesme değeri için duyarlılık %64,1, özgüllük %73,2 idi.

Sonuç: Çalışmamızda LER ve EMR'nin çocuklarda inek sütü alerjisini öngörmede yararlı parametreler olduğu görülmektedir. Bu çalışmanın bulguları, eozinofillerin yanı sıra lökositlerin de inek sütü alerjisi olgularında patogenezde önemli bir rol oynayabileceğini gösterebilir. Tam kan sayımı ile kolayca elde edilebilen eozinofil sayıları ve eozinofil indeksleri, inek sütü alerjisini ayırt etmede parametre olarak kullanılabilir.

Anahtar kelimeler: Çocuk, eozinofil, eozinofil-monosit oranı, inek sütü alerjisi, lökosit-eozinofil oranı

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Introduction

Cow's milk allergy (CMA) is an immunologic reaction to one or more milk proteins (1). CMA stands out as a prevalent form of food allergy among children aged below 24 months in developed nations (2); the prevalence in this age group was calculated to be 2-7.5% (3). Adverse reactions after cow's milk ingestion can occur at any age after birth, even in breastfed infants. The immune response to cow's milk proteins can be mediated by immunoglobulin E (IgE) or be independent of IgE (4). In most children, CMA develops with IgE-mediated reaction (5), and Th2 lymphocytes and eosinophils also play a significant role in the response of inflammation resulting from allergen binding to specific IgE (6). Platelets and neutrophils are indicators that play crucial roles in inflammation. Today, easy accessibility to these blood parameters allows them to be used to diagnose and monitor many diseases. According to studies, the platelet-lymphocyte ratio (PLR), neutrophil-lymphocyte ratio (NLR), and inflammation indices obtained from hemogram parameters are effective in diagnosing and monitoring cardiovascular diseases, malignancies, chronic inflammatory diseases, and allergic diseases like: allergic rhinitis, atopic dermatitis, and asthma (7-10).

It is crucial to avoid unnecessary initiation of elimination diets in children with CMA. The diagnosis of food allergy is still based on the principle that the causative allergen should be removed from the diet, and the symptoms should recur when added. Currently, there is no single commonly accepted diagnostic laboratory test to demonstrate an adverse immune response to cow's milk proteins (2). Although eosinophil indices have been studied in patients with allergic rhinitis, asthma and nasal polyps (10), there is an insufficient number of studies on these indices in children with CMA in the literature.

We aimed to evaluate eosinophil indices and other inflammatory parameters in pediatric patients with CMA, which are easily accessible and may be helpful in predicting CMA.

Materials and Methods

This retrospective study analyzed patient data from a University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital between September 2022 and September 2023. The records of the patients diagnosed with CMA by specific IgE tests were compared with children without CMA. The Ethical Committee of the University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital, gave its approval for the study (date: 27/10/2023, number: 2023/10/05/061). The research was carried out in accordance with the guidelines established by the Helsinki Declaration.

This research included 162 patients. The study included 39 people in the patient group and 123 age-and-gender-matched people in the control group. The study examined demographic data of the patients, including age at presentation and gender, as well as laboratory findings. The study included children under 24 months of age who underwent a specific IgE test for CMA and had simultaneous hemogram results. The study excluded parasitic diseases, malignancy, hematological diseases, and known infectious and systemic inflammatory diseases, as these conditions may affect eosinophilia levels. Systemic inflammation index (SII) was defined as (neutrophil×platelet)/lymphocyte; SIRI was defined as (neutrophil×monocyte)/lymphocyte; dNLR was defined as neutrophil count/(leukocyte count-neutrophil count); aggregate index of systemic inflammation (AISI) was defined as (neutrophil×platelet×monocyte)/lymphocyte. Eosinophil indices, including leukocyte-to-eosinophil ratio (LER), neutrophil-to-eosinophil ratio (NER), eosinophil-to-monocyte ratio (EMR), and eosinophil-to-lymphocyte ratio (ELR) were calculated based on hemogram parameters. In whole blood samples, hemogram parameters were measured by a Mindray BC-6800 Plus device (Shenzhen Mindray Bio-Medical Electronics Co), and specific IgE was measured using the chemiluminescent immunoassay method with the Immulite 2000 (Siemens Healthcare Diagnostics).

Statistical Analysis

To evaluate the normal distribution of continuous data, the Shapiro-Wilk test was employed. Continuous data were displayed as either mean with standard deviation or median with the 25th and 75th percentiles. The Mann-Whitney U test or Student's t-test was employed to compare continuous variables. The diagnostic performance of the laboratory parameters was evaluated through the receiver operating characteristic curve. The relationships between parameters were evaluated using Spearman correlation analyses. Statistical analyses were conducted using IBM SPSS v. 26.0 (IBM Corp., Armonk, NY, US) and GraphPad Prism 8.0 (GraphPad Software, San Diego, California, US). A significance level (p-value) of less than 0.05 was considered significant.

Results

The demographic data of our study are given in Table 1. There was no statistical difference in age, gender, leukocyte, platelet, monocyte, neutrophil, lymphocyte values, NLR, PLR, MLR, systemic inflammation response index, SII, and AISI between the patients with CMA and the control group (p>0.05). NER, dNLR and LER were significantly lower in the patients with CMA, whereas eosinophil, ELR and EMR were significantly higher than controls (p<0.001), as shown in Table 1 and Figure 1.

LER achieved the highest area under the curve (AUC) value of 0.716 [95% confidence interval (CI) =0.640-0.784] at a cut-off value of 22.2. EMR had an AUC value of 0.711 (95% CI=0.634-0.779) at a cut-off value of 0.30. ELR achieved an

Table 1. Comparing demographic and laboratory data between the two groups, considering the cow's milk allergy

Parameter	Control group (n=123)	Children with cow's milk allergy (n=39)	p-value
Age (months)	6 (4 to 10)	8 (5 to 11)	0.080***
Male sex, n (%)	62 (50)	22 (56)	0.638*
Specific IgE (kU/L)	0.10 (0.10 to 0.10)	0.55 (0.18 to 1.47)	**<0.001*** **
Leukocyte (10^9/L)	9.45 (7.12 to 11.5)	10.1 (8.09 to 12.1)	0.150***
Neutrophil (10^9/L)	2.53 (1.79 to 3.83)	2.33 (2.06 to 3.11)	0.380***
Platelet (10^9/L)	346 (304 to 446)	378 (289 to 453)	0.944***
Monocyte (10^9/L)	0.66 (0.55 to 0.82)	0.59 (0.49 to 0.94)	0.557***
Lymphocyte (10^9/L)	5.59±2.12	6.09±2.08	0.193**
Eosinophil (10^9/L)	0.28 (0.14 to 0.44)	0.47 (0.26 to 0.70)	**<0.001*** **
NLR	0.45 (0.31 to 0.89)	0.37 (0.26 to 0.62)	0.103***
PLR	67.8 (48.8 to 103)	58.3 (51.5 to 80.5)	0.215***
MLR	0.11 (0.09 to 0.18)	0.11 (0.07 to 0.16)	0.117***
SIRI	0.29 (0.19 to 0.66)	0.26 (0.15 to 0.42)	0.150***
SII	167 (103 to 330)	141 (103 to 189)	0.173***
AISI	115 (57.5 to 231)	91.9 (55.3 to 173)	0.161***
dNLR	0.39 (0.26 to 0.69)	0.30 (0.23 to 0.51)	**0.045*** **
LER	34.7 (21.5 to 65.1)	20.7 (14.2 to 32.5)	**<0.001*** **
NER	9.37 (5.25 to 21.2)	5.54 (3.00 to 8.25)	**<0.001*** **
ELR	0.05 (0.03 to 0.08)	0.08 (0.05 to 0.15)	**<0.001*** **
EMR	0.43 (0.17 to 0.68)	0.67 (0.42 to 1.26)	**<0.001*** **

*: Chi-square test, **: Student's t-test, ***: Mann-Whitney U test, Ig: Immunoglobulin, LER: Leukocyte-to-eosinophil ratio, NER: Neutrophil-to-eosinophil ratio, ELR: Eosinophil-to-lymphocyte ratio, EMR: Eosinophil-to-monocyte ratio, NLR: Neutrophil to lymphocyte ratio, dNLR: Derived neutrophil to lymphocyte ratio, PLR: Platelet to lymphocyte ratio, MLR: Monocyte to lymphocyte ratio, SIRI: Systemic inflammation response index, SII: Systemic inflammation index, AISI: Aggregate index of systemic inflammation

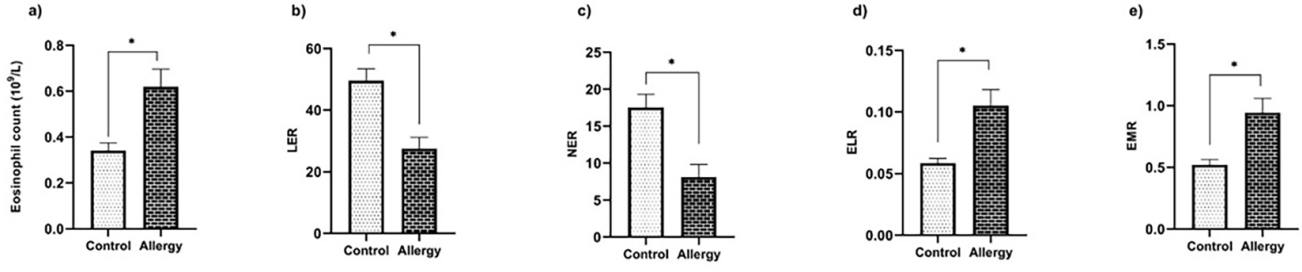

Figure 1. Comparing eosinophil and eosinophil indices between the two groups

**: p<0.001, LER: Leukocyte-to-eosinophil ratio, NER: Neutrophil-to-eosinophil ratio, ELR: Eosinophil-to-lymphocyte ratio, EMR: Eosinophil-to-monocyte ratio*

AUC value of 0.703 (95% CI =0.626-0.772) at a cut-off value of 0.06. NER achieved an AUC value of 0.703 (95% CI=0.626-0.772) at a cut-off value of 8.75 (Table 2).

In Spearman correlation, serum specific IgE levels were observed to have a negative correlation with LER (r=-0.340, p<0.001), NER (r=-0.319, p<0.001), and dNLR (r=-0.162, p=0.040), and positively correlated with eosinophil (r=0.337, p<0.001), EMR (r=0.330, p<0.001), and ELR (r=0.318, p<0.001) (Table 3).

Discussion

The study participants' age and gender were similar in all groups, ensuring that variations in inflammation marker levels can be attributed to specific factors rather than demographic differences. NER, dNLR, and LER were significantly lower in the patients with CMA. On the other hand, eosinophil, ELR, and EMR were significantly higher in the patients with CMA than in the controls. In determining the CMA group, the highest AUC was observed in LER. Moreover, LER had a higher correlation with specific IgE levels.

CMA is a prevalent food allergy among infants (11). Early recognition and appropriate management of CMA are crucial for the well-being of affected infants. The first step in the immune system's response to cow's milk protein allergy (CMPA) is a T-cell-dependent reaction (12). As a result, proinflammatory cytokines [interleukin (IL)-5, IL-13, and IL-14] are secreted by Th2 cells (13). This activates B-cells, leading to the secretion of IgE. When the same food allergen is ingested again, IgE binds to eosinophils, basophil, and mast cell surfaces and activates these cells, causing the release of mediators such as histamine that produce typical symptoms including anaphylaxis, laryngospasm, bronchospasm, angioedema, rhinitis, and urticaria within minutes to two hours (14). Allergic reactions to cow milk can be categorized into two main types: Immediate, which are typically IgE-mediated, and late-onset, encompassing both non-IgE-mediated and mixed IgE and cell-mediated reactions (15). IgE-mediated food allergy occurs with the development of food allergen-specific IgE, which develops after first contact with an allergen. Symptoms may be mild or may progress to anaphylaxis, which can be life-threatening. The oral food challenge has been regarded as the gold standard in diagnosing CMPA (16). Nevertheless, food intolerance and severe eosinophilia may cause symptoms to recur. Currently, no widely accepted diagnostic laboratory test will detect an undesirable immune system response to cow's milk proteins.

Eosinophils play a crucial role in immuno-inflammatory reactions in CMA (17). Because current indicators do not accurately represent inflammatory processes, their usefulness in this disease is limited. Thus, it is crucial to search for new biomarkers capable of detecting and

Table 2. Receiver operating curve analysis of eosinophil indices in identifying cow's milk allergy

Parameter	AUC	95 CI%	Cut-off	Sensitivity	Specificity	p-value
Eosinophil (10^9/L)	0.712	0.636 to 0.780	>0.39	66.7%	69.1%	**<0.001**
LER	0.716	0.640 to 0.784	≤22.2	64.1%	73.2%	**<0.001**
EMR	0.711	0.634 to 0.779	>0.30	92.3%	39.8%	**<0.001**
ELR	0.703	0.626 to 0.772	>0.06	64.1%	66.7%	**<0.001**
NER	0.703	0.626 to 0.772	≤8.75	79.5%	55.3%	**<0.001**

CI: Confidence interval, AUC: Area under the curve, LER: Leukocyte-to-eosinophil, EMR: Eosinophil-to-monocyte ratio, ELR: Eosinophil-to-lymphocyte ratio, NER: Neutrophil-to-eosinophil ratio

Table 3. Significant correlations between serum specific IgE levels and inflammation indices in all groups

Parameter	Specific IgE level (kU/L)	
	r	p
Eosinophil (10^9/L)	0.337	**<0.001**
LER	-0.340	**<0.001**
EMR	0.330	**<0.001**
ELR	0.318	**<0.001**
NER	-0.319	**<0.001**
dNLR	-0.162	**0.040**

LER: Leukocyte-to-eosinophil ratio, EMR: Eosinophil-to-monocyte ratio, ELR: Eosinophil-to-lymphocyte ratio, NER: Neutrophil-to-eosinophil ratio, Ig: Immunoglobulin, dNLR: Derived neutrophil-to-lymphocyte ratio

monitoring the dynamics of inflammation. Neutrophilic lipocalin associated with gelatinase (NGAL) and chemerin, markers associated with neutrophilic inflammation, was shown to be at higher levels in the CMA patient group than in the control group. Statistically significant correlations have been shown between IL-10, TNF-α, calprotectin, NGAL and WBC levels in children with CMA (18). Furthermore, the leukocyte adherence inhibition test has been proposed to discriminate antigen-specific immunoreactivity in non-IgE-mediated CMA (19). According to research, eosinophil-related indicators like eosinophil cationic protein and eosinophil protein X, were linked to intestinal inflammation in infants with atopic eczema and food allergies (20). Numerous studies have suggested that NLR and ELR could function as effective inflammatory indicators for differentiating between intermittent and persistent allergic rhinitis. Analyses have revealed that T-helper 2 lymphocytes, neutrophils, and eosinophils are all actively involved in the late-phase immune response that follows allergen exposure (21).

Study Limitations

The limitations of this study were its retrospective and single-center design. Total IgE, and clinical characteristics could not be obtained from all patient data.

Conclusion

In our study, LER and EMR seem to be useful parameters to predict CMA in children. These findings may indicate that leukocytes and eosinophils could play an important role in the pathogenesis of CMA. Eosinophil counts and eosinophil indices, readily obtainable through a complete blood count, can serve as parameters for distinguishing CMA. Understanding the immune response, particularly the role of eosinophils and leukocytes, could provide valuable insights into the pathogenesis, diagnosis, and potential predictors of tolerance in CMA. Studies on this subject are limited in the literature. We believe it will contribute to the literature. Moreover, more comprehensive studies are needed.

Ethics

Ethics Committee Approval: The Ethical Committee of the University of Health Sciences Turkey, İstanbul Bağcılar Training and Research Hospital, gave its approval for the study (date: 27/10/2023, number: 2023/10/05/061).

Informed Consent: Retrospective study.

Footnotes

Authorship Contributions

Concept: A.K.Ç., L.D., M.E., Design: A.K.Ç., L.D., M.E., Data Collection or Processing: A.K.Ç., L.D., M.E., Analysis or Interpretation: A.K.Ç., L.D., M.E., Literature Search: A.K.Ç., L.D., M.E., Writing: A.K.Ç., L.D., M.E.

Conflict of Interest: No conflict of interest was declared by the authors.

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References

1. NIAID-Sponsored Expert Panel, Boyce JA, Assa'ad A, Burks AW, Jones SM, Sampson HA, et al. Guidelines for the diagnosis and management of food allergy in the United States: report of the NIAID-sponsored expert panel. J Allergy Clin Immunol. 2010;126(Suppl 6):S1-58.
2. Vandenplas Y, Koletzko S, Isolauri E, Hill D, Oranje AP, Brueton M, et al. Guidelines for the diagnosis and management of cow's milk protein allergy in infants. Arch Dis Child. 2007;92(10):902-908.
3. Hill DJ, Hosking CS. Cow milk allergy in infancy and early childhood. Clin Exp Allergy. 1996;26(3):243-246.
4. Caffarelli C, Baldi F, Bendandi B, Calzone L, Marani M, Pasquinelli P, et al. Cow's milk protein allergy in children: a practical guide. Ital J Pediatr. 2010;36:5.
5. Fiocchi A, Brozek J, Schünemann H, Bahna SL, von Berg A, Beyer K, et al. World Allergy Organization (WAO) diagnosis and rationale for action against cow's milk allergy (DRACMA) guidelines. Pediatr Allergy Immunol. 2010;21(Suppl 21):1-125.
6. Bloom KA, Huang FR, Bencharitiwong R, Bardina L, Ross A, Sampson HA, et al. Effect of heat treatment on milk and egg proteins allergenicity. Pediatr Allergy Immunol. 2014;25(8):740-746.
7. Hirahara T, Arigami T, Yanagita S, Matsushita D, Uchikado Y, Kita Y, et al. Combined neutrophil-lymphocyte ratio and platelet-lymphocyte ratio predicts chemotherapy response and prognosis in patients with advanced gastric cancer. BMC Cancer. 2019;19(1):672.
8. Jimeno S, Ventura PS, Castellano JM, García-Adasme SI, Miranda M, Touza P, et al. Prognostic implications of neutrophil-lymphocyte ratio in COVID-19. Eur J Clin Invest. 2021;51(1):e13404.
9. Çoban Ağca M, Aksoy E, Duman D, Özmen İ, Yıldırım E, Güngör S, et al. Does eosinophilia and neutrophil to lymphocyte ratio affect hospital re-admission in cases of COPD exacerbation? Tuberk Toraks. 2017;65(4):282-290.
10. Çiçek F, Köle MT, Kandemir İ. The role of hematological parameters in the diagnosis of childhood allergic conjunctivitis. Bagcilar Med Bull. 2023;8(3):236-240.
11. Venter C, Pereira B, Grundy J, Clayton CB, Roberts G, Higgins B, et al. Incidence of parentally reported and clinically diagnosed food hypersensitivity in the first year of life. J Allergy Clin Immunol. 2006;117(5):1118-1124.

12. Eigenmann PA. Mechanisms of food allergy. Pediatr Allergy Immunol. 2009;20(1):5-11.

13. Klein SC, Boer LH, de Weger RA, de Gast GC, Bast EJ. Release of cytokines and soluble cell surface molecules by PBMC after activation with the bispecific antibody CD3 x CD19. Scand J Immunol. 1997;46(5):452-458.

14. Stone KD, Prussin C, Metcalfe DD. IgE, mast cells, basophils, and eosinophils. J Allergy Clin Immunol. 2010;125(Suppl 2):S73-S80.

15. Walsh J, Meyer R, Shah N, Quekett J, Fox AT. Differentiating milk allergy (IgE and non-IgE mediated) from lactose intolerance: understanding the underlying mechanisms and presentations. Br J Gen Pract. 2016;66(649):e609-e611.

16. Manuyakorn W, Benjaponpitak S, Siripool K, Prempunpong C, Singvijarn P, Kamchaisatian W, et al. Cow milk protein allergy presenting as feeding intolerance and eosinophilia: case reports of three preterm neonates. Paediatr Int Child Health 2015;35(4):337-341.

17. Suomalainen H, Soppi E, Isolauri E. Evidence for eosinophil activation in cow's milk allergy. Pediatr Allergy Immunol. 1994;5(1):27-31.

18. Ambroszkiewicz J, Gajewska J, Chełchowska M, Rowicka G. Assessment of inflammatory markers in children with cow's milk allergy treated with a milk-free diet. Nutrients. 2021;13(4):1057.

19. Olivier CE, Pinto DG, Teixeira AP, Santana JL, Santos RA, Lima RP. Leukocyte adherence inhibition test to the assessment of immunoreactivity against cow's milk proteins in non—IgE-mediated gastrointestinal food allergy. European Journal of Clinical Medicine. 2022;3(2):38-43.

20. Majamaa H, Aittoniemi J, Miettinen A. Increased concentration of fecal alpha1-antitrypsin is associated with cow's milk allergy in infants with atopic eczema. Clin Exp Allergy. 2001;31(4):590-592.

21. Kant A, Terzioğlu K. Association of severity of allergic rhinitis with neutrophil-to-lymphocyte, eosinophil-to-neutrophil, and eosinophil-to-lymphocyte ratios in adults. Allergol Immunopathol (Madr). 2021;49(5):94-99.