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The Role of Serum (Eotaxin-3) Related with Patients of Allergic Diseases from Iraqi Grain Silos Workers Who Had a Positive Result of Total IgE

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ABSTRACT

Through the identification of positive total IgE assay results in the serum and the estimation of Eotaxin-3 levels, this study sought to assess the role of (Eotaxin-3) in patients with allergic diseases from Silos workers. . The majority of Silos employees reported having similar symptoms, including red or itchy eyes, headache pain, cough, wheezing, nasal congestion, poor sense of smell, hives or swelling, shortness of breath, itchy or runny nose, frequent colds, frequent diarrhea, hoarse voice, or allergic asthma, allergic rhinitis, conjunctivitis, eosinophilia, and hyper eosinophilia syndrome. In this work, we showed that eotaxin-3 has a significant role in the pathogenicity of individuals with allergic illnesses in Silos who had elevated serum levels of total immunoglobulin E. One hundred and twenty subjects (eighty allergy patients and forty seemingly healthy controls) were used in the study to test the levels of Eotaxin-3 and Total IgE in the serum of the allergic patients as well as the control group. Using a VIDAS equipment, VIDAS®TOTAL IgE (IGE), Marcy-l' Etoile, France, the blood samples were utilized to estimate the serum total immunoglobulin-E (IgE) ratio. Blood Eotaxin-3 was also estimated. The ELISA MELSIN/China method quantitatively detects the Eotaxin-3 marker in patient serum and control serum. The results indicated that patients with allergic diseases had much higher concentrations of both IgE and Eotaxin-3 in their serum than did healthy controls ($p<0.001$). Additionally, there was no correlation between the levels of IgE and Eotaxin-3 in patients' serum; the correlation coefficient (r) between the two markers was = -0.06, and the level of significance was 0.642 (non-significant).

Keywords- total IgE, Eotaxin-3, allergic occupational disease.

I. INTRODUCTION

The improper immunological reactions being triggered by typically innocuous stimuli, such as foods, chemicals, house dust mites (HDMs), or pollens, is what is known as an allergic illness (T Nakayama et al., 2017). This type of disorder is known as "occupational allergic disease “which refers to symptoms brought on by allergens found in the workplace. It affects a large population, especially those who had to encounter allergens for a certain period of time, such as mill workers and silos (Anderson et al., 2017). For a lengthy amount of time, workers in silos were exposed to complex organic dust known as grain dust, in addition to a wide range of other allergens from the work environment, such as mold, animal dander, and plant proteins (Galli et al., 2008). According to the current definition, allergies are a group of IgE-mediated diseases. A protein that exhibits allergenic activity should have two properties: it should induce the IgE response, which includes cooperation between T, B, and dendritic cells during the sensitization phase, and it should induce a clinical response, involving both immediate and late-phase responses, to the same or similar protein on subsequent exposures (Akdis, 2006). Eotaxins are tiny proteins that belong to the chemokine class. They primarily affect eosinophils, which are blood cells implicated in the etiology of inflammatory diseases. This relationship results in participation of eotaxins in the

development of all agitating associated disorders like allergies. Eotaxins are useful markers for the identification, categorization, and therapy of allergic diseases. In the airways of asthmatics, eotaxins play a significant role as mediators of eosinophil recruitment and activation. The numerals "eotaxin-1, -2, and -3) have been assigned to the eotoxins to aid in their recognition. Additionally, it was found that all eotaxins exhibited the same level of activity and could bind to the aforementioned CCR3 receptor (Zajkowska and Mroczko, 2021). Together, these chemokine's most likely have a significant effect on the recruitment of different types of inflammatory cells that can support the type 2 chronic inflammatory response. CCL11, CCL24, and CCL26, the chemokine members of the eotaxin family is important in the recruitment of eosinophil's (Hulse et al., 2015). Chemokine (C-C motif) ligand 26 (CCL26) is a tiny cytokine that is specifically expressed by eosinophils. It is a member of the CC chemokine family and is also referred to as Eotaxin-3/CCL26. According to Kagami et al. (2005), CCL26 was generated by vascular endothelial cells and cutaneous fibroblasts. The eotaxin-3 gene is grouped along chromosome 7's long arm (7q11.23). Furthermore, the main producers of eotaxin-3 are endothelial cells, dermal fibroblasts, and HUVECs (human umbilical vein endothelial cells), energized by IL-4, since it shares comparable location and activities with eotaxin-2 (Huber et al., 2018). The functions of the three eotaxin molecules are both distinct and overlap. While it has been established that Eotaxins 1 and 2 are Critical for attracting killer lymphocytes and monocytes to inflammatory areas, CCL26 also attracts basophils, T helper (Th) 2 CD4+ lymphocytes, and mast cells. These molecules also have an impact on other innate immune cells (Nakayama et al., 2010). According to recent research, interleukin-5 and eotaxins are correlated because they both promote the recruitment and accumulation of eosenophils, which in turn causes allergic asthma (Aoki et al., 2021).

Tissue-resident mast cells and macrophages mediate the early inflammatory processes, which leads to the production of pro-inflammatory mediators. (IL-4, IL-5), which in turn triggers the activation of adaptive immune cells. This process is linked to dysregulation that includes several activities. There is a substantial correlation between the release of eotaxins and inflammatory cells, such as mast cells, basophils, eosinophils, and Th 2 lymphocytes. Tissue remodeling, the next phase of persistent inflammation, could result from this. This results in significant modifications to both the long-term alterations to the structural elements of the affected areas (such as enhanced vascularity) and the barrier function of the affected epithelia). Tissue eosinophilia is linked to elevated eotaxin expression in tissues because EOS move to areas with greater eotaxin concentrations (Singh et al 2019).

According to a research by Provost et al. (2013), CCL26 is a more potent chemo attractant for asthmatics' eosinophils than CCL11 and CCL24. The study's findings also suggested that CCL26 might have a special and significant role in the eosinophil recruitment in persistent asthma. Additionally, eotaxins, specifically stimulate the chemokine receptor CCR3 which aids in the eosinophil build-up associated with atopic disorders. This could imply that those proteins are important in the development of these conditions and could help differentiate between eosinophilic and non-eosinophilic illnesses. (Tian et al., 2019). Compared to other antibody isotypes, IgE has a greater affinity for the Fc receptor (FceRI) than the other immunoglobulin isotypes, while being less prevalent in serum. The production of IgE requires two signals.IL-4 or IL-13, which stimulate transcription at a particular immunoglobulin gene, provide signal 1. The activation of DNA switch recombination on B cells by CD40 ligation provides the second signal. These signals primarily originate from T cells (Gould et al., 2003).

In the mucosae, sequential switching from IgG may result in class switch recombination to IgE. As a result, local effector cells become sensitized quickly, and mucosal secretions contain free IgE. Despite the fact that these factors clarify how IgE is involved in respiratory illnesses. In allergic rhinitis and allergic asthma, an eosinophilic inflammation of the atopic patient's airway mucosa is brought on by IgE sensitization to environmental allergens. Because IgE functions as a mediator of airway disorders, this marker can be used as a target for therapy (Eguiluz -Gracia et al., 2019).

Strict control over the cellular and molecular mechanisms generating high-affinity IgE results in serum concentrations (Wu and Zarrin, 2014). It is believed that a significant portion of circulating IgE starts in the mucosae and spreads via the lymphatic system (Coeffier et al., 2005). Compared to the circulation, respiratory secretions contain a substantially higher amount of IgE, and this relative abundance is particularly important when it comes to IgE that is directed against aeroallergens. (Dullaers et al., 2012).), and it is thought that the mucosae are the source of a sizable amount of circulating IgE, which then spreads into the lymphatic system (Coeffier et al., 2005). According to a 2012 study by J. Eckl-Dorna and colleagues, local IgE production in tissues is a primary source of allergen-specific IgE. The majority of allergen-specific IgE in peripheral blood is not obtained from IgE-secreting cells in the blood (Eckl-Dorna et al 2012). In order to avoid the development of allergen/IgE/receptor complexes, a number of mediators compete with IgE for binding to allergens (Dodev et al., 2015).

II. MATERIAL AND METHODS

Study group: Out of the 120 subjects, 80 were allergic patients (71 males and 9 females), while the remaining 40 were healthy controls (24 males and 18 females) with normal serum total IgE concentrations and no signs of allergy or other disease. Blood samples were taken, and sera were separated and kept at -70 °C until used for serological testing. The VIDAS device was used to estimate the serum total immunoglobulin-E (IgE) ratio. VIDAS®TOTAL IgE (IGE) is a

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quantitative, automated test on VIDAS family instruments that allows the determination of total human IgE in human serum or plasma (lithium heparinate or EDTA) by means of the Enzyme Linked Fluorescent Assay (ELFA)/ Sandwich assay bioMérieux SA RCS LYON 673 620 399 69280 Marcy-l'Etoile /France. The level of serum Eotaxin-3 was estimated. The ELISA Kit that MELSIN/China uses allows for the quantitative detection of the Eotaxin-3 marker in patient and control serum using the ELISA method.

III. RESULTS

All patients had statistically significant increases in serum eotaxin-3 and total IgE concentrations when compared to the healthy control group ($p<0.001$). There was no discernible relationship between the levels of total IgE and Eotaxin-3. According to our findings, which are displayed in figures (1) and table (1), the total IgE level of allergic patients was 194.78 ±30.41 IU/ml, significantly higher at **p≤ 0.01 than the controls' level of 10.36 ±1.03 IU/ml (P=0.0018), and the Eotaxin-3 level of allergic patients was 3.761 ±0.51, highly significant at ** P≤0.01 than the controls' level of 1.331 ±0.11)

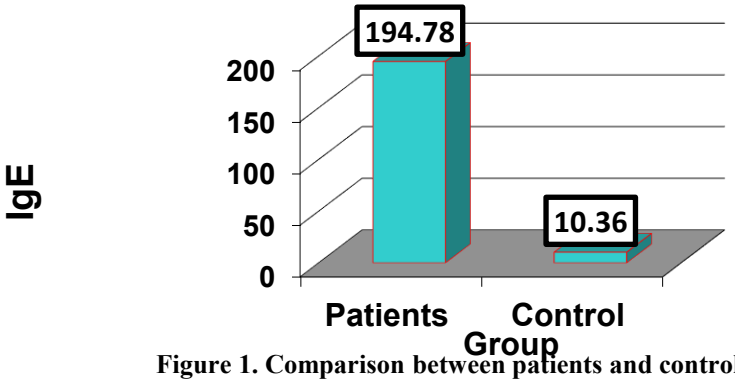

Figure 1. Comparison between patients and control in IgE

Our result were agreement with a research by (Ansotegui et al., 2020), It demonstrated that increased IgE concentrations are typically associated with allergy diseases (Ansotegui et al., 2020).

Table 1: Comparison between patients and control groups in IgE and Eotaxin-3

Group	Mean ± SE	
	IgE total (IU/ml)	Eotaxin-3 (pg/ml)
Patients	194.78 ±30.41	3.761 ±0.51
Control	10.36 ±1.03	1.331 ±0.11
LSD value	113.564 **	1.923 **
P-value	0.0018	0.00139
The means that had distinct letters in the same column varied considerably. ** (P≤0.01).		

As can be seen in figure 2, the Eotaxin-3 levels of the allergic patients (3.761 ±0.51 Pg/ml) were substantially greater than those of the controls (1.331 ±0.11 Pg/ml), with a P value of 0.00139.

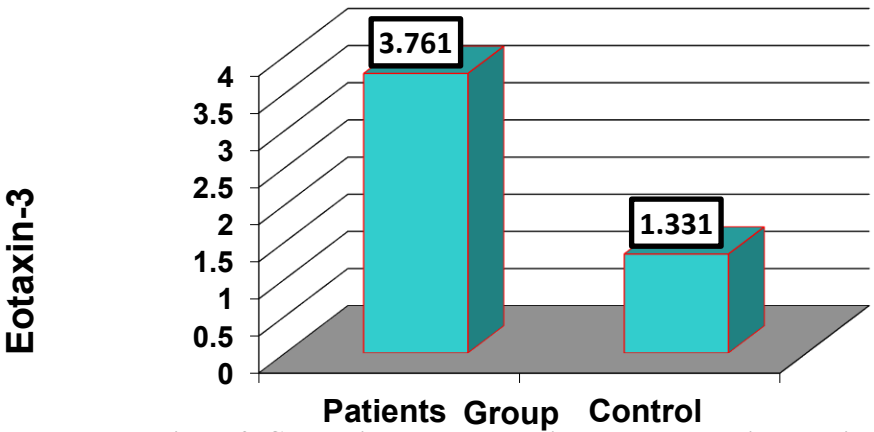

Figure 2. Comparison between patients and control in Eotaxin-3

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The results in the present study showed that patients with respiratory allergic disease were significantly higher Eotaxin -3 levels in serum compared to healthy controls shown in table(1).

Our findings were in line with a research by Singh et al. (2019), which demonstrated that inflammatory processes are associated with high serum or plasma concentrations as well as tissue expression of eotaxins. It is also possible that eosinophil and basophil activation, which secretes these chemokines, occurs in the bloodstream as well as in tissues. Additionally, the outcome demonstrated consistency with the findings of (Tian et al., 2019). Eotaxin-3 tissue expression was observed to be significantly greater in patients with eosinophilic nasal polyposis. Additionally, a study by Nakayama et al. (2010) showed agreement with our results by claiming that Eotaxin-3 is a chemo attractant for basophils and eosinophils, and it may help cause the buildup of eosinophils in atopic illnesses.. A different study states that Eotaxin-3, like other eotoxins, activates the chemokine receptor CCR3 and contributes to the eosinophil accumulation in atopic diseases, which is consistent with our findings (Tian et al., 2019). The correlation coefficient between Eotaxin-3 and IgE levels in patient serum was one of the study's findings. Table 2 showed that there was no correlation between Eotaxin-3 and IgE levels in allergic patients of grain silos, and the correlation coefficient between them was -r = (-0.06) compared with a significance level of 0.642, indicating that the relationship was not significant.

Table 2: Correlation coefficient between Eotaxin -3 and Total IgE in serum of allergic patients

Parameters	Correlation coefficient-r	Level of Sig.
Eotaxin-3 & Total IgE	-0.06	0.642 NS
NS: Non-Significant.		

Our findings concurred with a research by Wang et al. (2013) that found no significant relationship between the levels of eotaxin and serum total IgE in patients with asthma.

IV. DISCUSSION

The immunological environment of allergic diseases may not be fully understood. In a normal state, Th1 and Th2 are in a dynamic balance; however, when an allergic disease arises from exposure to environmental allergens, this balance is broken. Th2 plays a triggering role in the induction of mast cells, eosinophils, and B cells that produce IgE antibodies. These cells are found in all tissues that are exposed to environmental allergens, particularly in the gastrointestinal (GI) tract, skin, nose, mouth, and throat (Khaitov et al., 2018). IgE is crucial for both the acute and chronic phases of allergy disease due to its capacity to influence the function of numerous immune cells, including mast cells, eosinophils, and structural cells of the lung's bronchial wall (Froidure et al., 2016).

The number of various allergens to which a patient is sensitive directly affects the likelihood of detecting an elevated level of total IgE in serum in that patient. Some patients may have normal serum levels of total IgE, especially if they have limited involvement of end organs and are sensitive to a small number of allergens.

A normal concentration of total IgE does not imply the absence of allergic disease (Martins et al., 2014). According to reports from the past ten years, eotaxins, which are small proteins that belong to the chemokine group, primarily act on eosinophils. As demonstrated by our findings from Figure 1 and Table 1, eotaxins have multiple applications, not only as markers for the diagnosis of allergy as well as to identify the type (eosinophilic or non-eosinophilic) and origin of allergic disease (Zajkowska and Mroczko, 2021). It is a chemo attractant for basophils and eosinophils, and it may help eosinophils accumulate in atopic illnesses (Nakayama et al., 2010). All eotaxins are implicated in allergic illnesses, which are classified as inflammatory diseases. For instance, the primary mechanism of action in asthma is linked to eosinophil tissue formation throughout the bronchial wall. Secretory granules found in eosinophils are linked to the distinctive deep pink discoloration seen in hematoxylin and eosin preparations. There are various ways to discharge the contents of those granules locally. Activated human eosinophils carry out extracellular granule expulsion as part of their cytolysis process within tissues. Following degranulation, these granulocytes—possessing several traits that promote inflammatory processes—emittan eosinophil peroxidase and eosinophil cationic protein, which can cause damage to nearby tissues. Thus, it is thought that eosinophils are important for the bronchial hyperreactivity that causes asthma. Eotaxins can facilitate the migration of eosinophils from the bloodstream into tissues by attaching to the CCR3 on the surface of white blood cells (Fulkerson and Rothenberg, 2018). Thus, it is likely that the concentration of these proteins rises in all inflammatory conditions when the activation of T helper cells, basophils, and eosinophils is predominant (Zajkowska and Mroczko, 2021). Eotaxin-3 is mostly generated by epithelial and endothelial cells, and it primarily activates the CCR3, which is strongly expressed on eosinophils, as indicated in figure (2) table (1) of our results. The characteristic epithelial cell dam that is seen in asthma can be caused by lung-derived eotaxins, which can also locally increase the release of ROS and cationic proteins and cause eosinophil recruitment from the bronchial mucosa to the bone marrow. We may claim that CCL11, CCL24, and CCL26 are known chemokines for eosinophils since eosinophil recruitment is a crucial stage in the pathophysiology of allergy disorders and asthma (Provost et al., 2013). Furthermore, studies by Raby et

al. (2006) and Chae et al. (2004) indicate that eotaxin may influence B-cell-mediated IgE synthesis in a more indirect manner by eosinophil activation, which in turn alerts T and B cells. These results agree with what we found.

V. CONCLUSIONS

1. The following conclusions are drawn from this study: 1. Eotaxin-3 is a critical biomarker for identifying long-term allergic disease, and it plays a particularly useful role in respiratory allergic disease.
2. Grain dust is a very dangerous material and this has become a public worry since repeated exposure to the dust concentration above workplace exposure limit may cause deterioration in lung function.
3. Despite the lack of a relationship, increasing serum total IgE levels will also raise eotaxin-3 levels.

REFERENCES

[1] Akdis, C. A. (2006). Allergy and hypersensitivity: mechanisms of allergic diseas Current opinion in immunology, 18(6), 718-726.3
[2] Anderson SE, Long C, Dotson GS. OCCUPATIONAL ALLERGY. Eur Med J (Chelmsf). 2017 Jun;2(2):65-71. PMID: 30976662; PMCID: PMC6454566 .
[3] Ansotegui, I. J., Melioli, G., Canonica, G. W., Caraballo, L., Villa, E., Ebisawa, M., ... & Zuberbier, T. (2020). IgE allergy diagnostics and other relevant tests in allergy, a World Allergy Organization position paper. World allergy organization journal, 13(2), 100080.
[4] Aoki, A., Hirahara, K., Kiuchi, M., & Nakayama, T. (2021). Eosinophils: cells known for over 140 years with broad
[5] Chae, S. C., Lee, Y. C., Park, Y. R., Shin, J. S., Song, J. H., Oh, G. J., ... & Chung, H. T. (2004). Analysis of the polymorphisms in eotaxin gene family and their association with asthma, IgE, and eosinophil. Biochemical and biophysical research communications, 320(1), 131-137.
[6] Coeffier, M., Lorentz, A., Manns, M. P., & Bischoff, S. C. (2005). Epsilon germ-line and IL-4 transcripts are expressed in human intestinal mucosa and enhanced in patients with food allergy. Allergy, 60(6), 822-827.
[7] Dodev, T. S., Bowen, H., Shamji, M. H., Bax, H. J., Beavil, A. J., McDonnell, J. M., ... & James, L. K. (2015). Inhibition of allergen-dependent IgE activity by antibodies of the same specificity but different class. Allergy, 70(6), 720-724.
[8] Dullaers, M., De Bruyne, R., Ramadani, F., Gould, H. J., Gevaert, P., & Lambrecht, B. N. (2012). The who, where, and when of IgE in allergic airway disease. Journal of Allergy and Clinical Immunology, 129(3), 635-645.
[9] Eckl-Dorna, J., Pree, I., Reisinger, J., Marth, K., Chen, K. W., Vrtala, S., ... & Niederberger, V. (2012). The majority of allergen-specific IgE in the blood of allergic patients does not originate from blood-derived B cells or plasma cells. Clinical & Experimental Allergy, 42(9), 1347-1355.
[10] Eguiluz-Gracia, I., Layhadi, J. A., Rondon, C., & Shamji, M. H. (2019). Mucosal IgE immune responses in respiratory diseases. Current Opinion in Pharmacology, 46, 100-107.
[11] Froidure, A., Mouthuy, J., Durham, S. R., Chanez, P., Sibille, Y., & Pilette, C. (2016). Asthma phenotypes and IgE responses. European Respiratory Journal, 47(1), 304-319.
[12] Fulkerson, P. C., & Rothenberg, M. E. (2018). Eosinophil development, disease involvement, and therapeutic suppression. Advances in immunology, 138, 1-34.
[13] Galli, S. J., Tsai, M., & Piliponsky, A. M. (2008). The development of allergic inflammation. Nature, 454(7203), 445-454.
[14] Geha, R. S., Jabara, H. H., & Brodeur, S. R. (2003). The regulation of immunoglobulin E class-switch recombination. Nature Reviews Immunology, 3(9), 721-732.
[15] Gould, H. J., Sutton, B. J., Beavil, A. J., Beavil, R. L., McCloskey, N., Coker, H. A., ... & Smurthwaite, L. (2003). The biology of IGE and the basis of allergic disease. Annual review of immunology, 21(1), 579-628.
[16] Huber, A. K., Giles, D. A., Segal, B. M., & Irani, D. N. (2018). An emerging role for eotaxins in neurodegenerative disease. Clinical Immunology, 189, 29-33.
[17] Hulse, K. E., Stevens, W. W., Tan, B. K., & Schleimer, R. P. (2015). Pathogenesis of nasal polyposis. Clinical & Experimental Allergy, 45(2), 328-346.
[18] Khaitov,M.R, A. R. Gaisina, I. P. Shilovskiy, V. V. Smirnov, G.Ramenskaia, A. A. Nikonova, R. M. Khaitov, 2018, The Role of Interleukin_33 in Pathogenesis of Bronchial Asthma. Biochemistry, 2018, 83(1): 13-25.
[19] Martins, T. B., Bandhauer, M. E., Bunker, A. M., Roberts, W. L., & Hill, H. R. (2014). New childhood and adult reference intervals for total IgE. Journal of Allergy and Clinical Immunology, 133(2), 589-591.
[20] Nakayama, T., Watanabe, Y., Oiso, N., Higuchi, T., Shigeta, A., Mizuguchi, N., ... & Yoshie, O. (2010). Eotaxin-3/CC chemokine ligand 26 is a functional ligand for CX3CR1. The Journal of Immunology, 185(11), 6472-6479.

[21] Provost, V., Larose, M. C., Langlois, A., Rola-Pleszczynski, M., Flamand, N., & Laviolette, M. (2013). CCL26/eotaxin-3 is more effective to induce the migration of eosinophils of asthmatics than CCL11/eotaxin-1 and CCL24/eotaxin-2. Journal of leukocyte biology, 94(2), 213-222.

[22] Raby, B. A., Van Steen, K., Lazarus, R., Celedón, J. C., Silverman, E. K., & Weiss, S. T. (2006). Eotaxin polymorphisms and serum total IgE levels in children with asthma. Journal of allergy and clinical immunology, 117(2), 298-305.

[23] Singh, N., Baby, D., Rajguru, J. P., Patil, P. B., Thakkannavar, S. S., & Pujari, V. B. (2019). Inflammation and cancer. Annals of African medicine, 18(3), 121.

[24] Stevens, W. W., Lee, R. J., Schleimer, R. P., & Cohen, N. A. (2015). Chronic rhinosinusitis pathogenesis. Journal of Allergy and Clinical Immunology, 136(6), 1442-1453.

[25] Tian, P., Ou, H., Wu, F., Ma, Y., Liu, X., Chen, Q., ... & Zou, H. (2019, March). Interleukin-4–induced posttranscriptional gene regulation of CCL26 by the RNA-binding protein HuR in primary human nasal polyp–derived epithelial cells. In International forum of allergy & rhinology (Vol. 9, No. 3, pp. 311-321).and new functions. Allergology International, 70(1), 3-8.

[26] Wang, X., Ma, C., Zhang, Y., Ning, L., Chen, H., & Zhou, F. (2013). Clinical significance of the dynamic changes in serum eotaxin, interleukin 13 and total IgE in children with bronchial asthma. Iranian journal of pediatrics, 23(5), 525.

[27] Wu, L. C., & Zarrin, A. A. (2014). The production and regulation of IgE by the immune system. Nature Reviews Immunology, 14(4), 247-259.

[28] Zajkowska, M., & Mroczko, B. (2020). Eotaxins and their receptor in colorectal cancer—a literature review. Cancers, 12(6), 1383.

[29] Zajkowska, M., & Mroczko, B. (2021). From Allergy to Cancer—Clinical Usefulness of Eotaxins. Cancers, 13(1), 128.