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Study of total Immunoglobulin E and Eosinophil count in allergic disease

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Abstract:

The present study aimed to evaluate the levels of total immunoglobulin E and percentage count of eosinophil in some of allergic disease. Blood sample collected from 210 patients (110 female, 100 male) with allergic disease (allergic asthma, allergic rhinitis, and urticaria) their age between 10-70 years and 50 healthy control their age between 23-52 years. A highly significant ($P < 0.01$) increase in the mean serum total IgE in patients with asthma (503.54 ± 63.49 IU/ml), Allergic rhinitis (442.77 ± 95.76 IU/ml) and urticaria (489.53 ± 69.68 IU/ml) as a compared with healthy controls (23.67 ± 5.81 IU/ml). There was a significant difference in percentage count of eosinophil in patients groups allergic asthma $4.37 \pm 0.52\%$, allergic rhinitis $4.38 \pm 0.50\%$, and urticaria $4.12 \pm 0.43\%$ as compared to healthy control $2.57 \pm 0.86\%$. The mean of serum total IgE levels and eosinophil counts may be helpful in the diagnosis of allergic disease.

Key words: Asthma, Rhinitis, Urticaria, Immunoglobulin E, Eosinophil.

Introduction:

Allergic and Type I hypersensitivity reactions are the results of immune response to allergens, This response is mediated by IgE antibody specific to the allergen, Mast cells and basophiles are activated after IgE bindings, starting a serious of cellular and molecular events that results in the clinical manifestation of allergic diseases [1]. Asthma is a chronic allergic disorder of the airways, in which many cells and cellular elements play a role in particular mast cells. The inflammation causes recurrent symptoms of breathlessness, wheezing, chest tightness

and cough, usually there is a widespread airflow obstruction with these episodic symptoms, which is reversible to varying degrees either spontaneously or with treatment [2]. Allergic rhinitis is an acute IgE mediated type I hypersensitivity reaction of nasal mucosa in response to antigenic substances (allergens) associated with episodic attacks of sneezing, watery rhinorrhea and watering of the eyes, patients also present tightness of chest, due to subclinical bronchospasm [3]. Urticaria (hives) is a common disorder, occurring in 15- 25% of individuals at

some point in life, it is characterized by recurrent, pruritic (itchy), pink-to-red edematous (swollen) lesions that is often have pale centers (wheals). The lesions can range in size from a few millimeters to several centimeters in diameter, and are often transient, lasting for less than 48 hours [4].

IgE determination is valuable in the diagnosis of allergic diseases such as, asthma, allergic rhinitis, urticaria, atopic dermatitis and some parasitic infections which leads to increase IgE levels [5]. Among the non-infectious diseases associated with eosinophilia are allergic diseases, including allergic rhinitis, conjunctivitis, and asthma, eosinophils are present in involved tissues as well as increase in blood [6]. The eosinophil is a multifunctional leukocyte playing a central role in Th2 mediated allergic diseases. parasitic killing and tissue repair[7]. Recent studies have pointed out eosinophil involvement in modulating both innate and adaptive immune responses [8]. Previous studies demonstrated that, the number of eosinophils is increased in blood and tissue in patients with atopic diseases [9,10]. Many investigators used total IgE and eosinophil count for evaluating allergic diseases [11,12,13]. The aim of this study is to investigate the role T-IgE level and Eosinophil count in patients with allergic asthma; allergic rhinitis and allergic urticaria compared to the healthy control.

Material and Methods:

This study was carried out at the allergy specialized center in Baghdad/AL-Resafa from April 2014 to September 2014, 210 patients with allergic disease were classified into three groups, (77 Asthma, 48 Rhinitis, and 85 Urticaria) and 50 individual as a healthy control. Both physical and clinical examinations were done for each subject and the information was recorded in a data sheet.

Blood samples were collected for estimation of serum total IgE by sandwich ELISA, read the results automatically by ELISA readers, using kit from Dr.Foke (Germany), the value over 100 IU / ml were considered high and the eosinophil counts were done by Beckman coulter analyzer, the percentage of eosinophil count below 4% was used as the reference value for normal levels of eosinophils. The sample results were calculated by using standard curve fitting equations for T-IgE (figure 1).

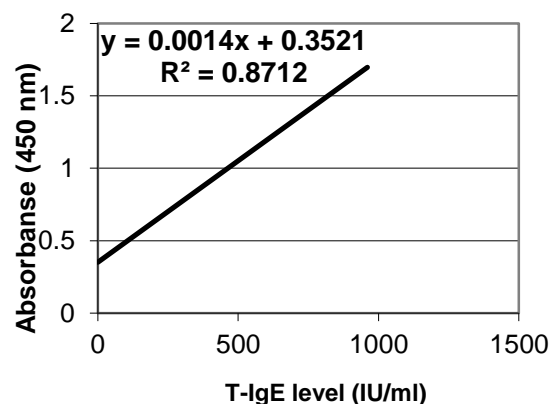


Fig. (1): The Standard Curve of IgE IU/ml

Statistical Analysis:

The Statistical Analysis System- SAS (2012) was used to effect of different factors in study parameters. Least significant difference –LSD test was used to significant compare between means. Estimate of correlation coefficient between difference parameters in this study [14].

Results:

The mean level of serum Total IgE levels in study groups are summarized in table (1), there is a highly significant ($P < 0.01$) increase in the mean of total serum IgE in patients with asthma (503.54 ± 63.49 IU/ml), Allergic rhinitis (442.77 ± 95.76 IU/ml) and urticaria (489.53 ± 69.68 IU/ml) as compared with healthy controls (23.67 ± 5.81 IU/ml).

Table (1) The level of total IgE in study groups

Study groups	No.	Range	T-IgE(IU/ml) Mean ± SE
Allergic asthma	77	12-568.32	503.54 ± 63.49**
Allergic rhinitis	60	10-1000	442.77 ± 95.76**
Allergic urticaria	82	11.43-1000	489.53 ± 69.68**
Healthy control	50	10.5-56.61	23.67 ± 5.81
LSD value	246.51 **		
P-value	0.0061		

** (P≤0.01)

The mean serum T-IgE level according to age groups are shown in table (2). There are a significant (P<0.05) increase in mean serum level T-IgE in patients in age group (30-39 years) with allergic asthma (558.049 ± 89.13pg/ml), allergic rhinitis (513.934 ± 72.49pg/ml), and urticaria (503.262 ± 113.7 pg/ml), when compared with healthy controls (42.05 ± 17.43pg/ml).

Table (2) Distribution of T-IgE in Allergic patients according to age groups

Age groups (years)	Healthy control		Asthma		Rhinitis		Urticaria	
	No.	T-IgE	No.	T-IgE	No.	T-IgE	No.	T-IgE
<20	6	28.03 ± 7.59	15	365.913 ± 84.37	7	329.934 ± 79.52	7	272.88 ± 54.79
20-29	19	32.31 ± 8.34	11	486.91 ± 61.28	12	471.823 ± 92.55	22	461.742 ± 73.94
30-39	11	42.05 ± 17.43	29	558.049 ± 89.13	12	513.934 ± 72.49	24	503.262 ± 113.7
40-50	10	23.43 ± 5.19	18	352.958 ± 54.84	10	245.012 ± 80.17	20	392.662 ± 64.84
>50	4	30.0 ± 5.48	4	249.608 ± 61.28	7	191.086 ± 42.77	12	184.102 ± 39.16
Total	50		77		48		85	
LSD value	--	28.91	--	184.39 *	---	241.07 *	---	181.36 *

*(P≤0.05).

There is a significant (P<0.05) increase in mean serum T-IgE in patients, through gender groups compared to the healthy control. Table (3) shows the mean of serum T-IgE levels in male

increase in asthma 506.025 ± 138.7 IU/ml, while in female increase in rhinitis 511.398 ± 103.6 IU/ml and urticaria 412.95 ± 91.74 IU/ml.

Table (3) Distribution of T-IgE in Allergic patients according to gender groups

Gender	Healthy control		Asthma		Rhinitis		Urticaria		Total
	NO.	T-IgE (IU/ml)	NO.	T-IgE (IU/ml)	NO.	T-IgE (IU/ml)	NO.	T-IgE (IU/ml)	
Male	25	24.351 ± 6.22	34	506.025 ± 138.7	19	329.328 ± 73.44	47	212.067 ± 52.69	100
Female	25	17.308 ± 4.93	43	432.185 ± 84.68	29	511.398 ± 103.6	38	412.95 ± 91.74	110
Total	50		77		48		85		210
LSD value	--	11.38	--	63.47 *	--	121.59 *	--	138.91 *	---

*(P≤0.05).

As shown in table (4), there is a significant difference in percentage of eosinophil count in patients groups allergic asthma 4.37 ± 0.52%, allergic rhinitis 4.38 ± 0.50%, and urticaria 4.12 ± 0.43% as compared with healthy control 2.57 ± 0.86%.

Table (4) The percentage of Eosinophil count in study groups

Groups	NO.	Range	Eosin.(%) Mean ± SE
Allergic asthma	77	1-11	4.37 ± 0.52*
Allergic rhinitis	60	1-7	4.38 ± 0.50*
Urticaria	82	1-9	4.12 ± 0.43*
Healthy control	50	2-8	2.57 ± 0.86
LSD value	1.760 *		
P-value	0.0549		

*(P≤0.05)

Discussion:

Allergic diseases are characterized by the IgE-dependent release of mast cell-derived mediators and cellular infiltration particularly of activated eosinophils and T-lymphocytes [15].

IgE not only provides protective immunity against helminth parasites but also mediate type-1 hypersensitivity reactions, that contribute to the pathogenesis of allergic diseases such as; asthma, allergic rhinitis and atopic dermatitis [16].

There were significant differences in the levels of (T-IgE) among different age groups in asthma, where recorded (30-39 years), the highest level was 558.049 ± 89.13 pg/ml among other categories represent more active and contact with environmental allergens, these findings are in agreement with the results of [1], in Iraq, who found patients with detectable levels of serum total IgE (>100 IU/ml) gradually increased with age, with a maximum being observed in the 31-40 year old group, but the level of T-IgE in allergic disease declined with age after 50 years old, compared with younger subjects, that results were similar with previous studies by [1], [17] and [18], they found a lower prevalence of allergic disease in the most advanced ages, both in control subjects and in individuals affected by allergic respiratory, allergic rhinitis and urticaria. These results are in agreement with [19], who reported showed that most of the rates of allergic were in the age range (27-35) years, and then decreased with age in Iraqi patients. Aging is associated with modifications of the immune system, defines as immunosenescence, this could contribute to a reduce prevalence of allergic diseases in elderly populations [17].

The results of this study showed that allergic disease was different in both genders. Allergic asthma was increased with male more than female, this was in agreement with the study of [20], in

USA, who stated that asthma common in males more than females, while [21], in Pakistan who concluded that the frequency of allergic rhinitis was significantly different in both genders and found in female more than male. The results of the present study are in agreement with in Portugal, [22], who found that there was a female dominance in the studied population for allergic rhinitis, while disagree results of the present study in Iraq [1], where showed that allergic rhinitis was dominant in male more than female due to sample size or environmental effects. These results are in agreement with [23], who showed urticaria in approximately 0.5% of the general population and has a female preponderance. In Iraq [24], showed that chronic urticaria increased in female more than male and this consistent with the results of the current study. This elevation may be due to hormonal variations in female sex that include (a defect in an endocrinopathy, menstrual cycle, pregnancy, menopause and hormonal contraceptives), environmental or genetic conditions beside the psychological change of Iraqi people which results in highly stress that enhance allergic disease development.

The current study provides additional support to the key role played by IgE in mediating, maintaining, and severity of the allergic response in allergic patients manifested by the elevated levels of IgE compared with healthy control [25].

Where [1] and [26], found an elevated IgE value is suggestive of the diagnosis allergic rhinitis, and explained test results T-IgE there is marked increase in levels of this antibody in patients with asthma compared with control .

The present results are in agreement with the results of [19], who showed a significant differences in total IgE levels between allergic disease and healthy control. [27], found that total IgE levels was a high significant increase in asthma (453.6 ± 40.28) compared to the healthy control (105.44 ± 16.85), these results are similar to what was done by [28] in Turkey, showed IgE antibody to be higher in patients with chronic urticaria compared with healthy control.

This may be explained that the allergic diseases, such as allergic asthma, allergic rhinitis and urticaria are characterized by an increased number of eosinophil granulocytes in the circulating blood and degranulation in the target tissue is considered the major pathogenic event [19, 27, 29].

Eosinophils are known to be the main effector cells of allergic process, it is important during the initial and later stages of allergic airway diseases [30]. Bases on the presented results, there is a significant increase in eosinophil count percentage in patients as compared to healthy controls. Several studies have reported that higher serum total IgE levels and eosinophilia were present in patients with allergic disease [31].

Conclusion:

It has been found that increased levels of T-IgE and eosinophil count in serum of allergic disease. All Iraqi allergic patients with different age level showed significant increased level of total IgE compared to the healthy controls. The concentration of T-IgE varied between male and female according to the allergic disease. There was a significant increase in percentage count of eosinophil in patients with allergic asthma, rhinitis and urticaria.

References

- [1] Brakhas, S. A.; Atia, M. R.; Aziz, Y. J. and AL-Sharqi, S. A. H. 2015.

Study of total IgE levels and eosinophil count according to age and gender in patients with allergic rhinitis. *World J Pharm Res.*, 4(1):295-303.

- [2] Abbas, A.; Shahid, S. Sabah, A.; Beg, A. E.; Ahmed, F. R.; Sidra Tanwir, S.; Ahmed, S. W.; Kashif, M.; Jatoi, A. H.; Rizvi, S. A.; and Qidwai, M. A. 2014. The clinical complications of Asthma and its pharmacotherapy. *J British biomelical Bulletin.* 2(1): 2347-5447.
- [3] Hazarika, P.; Nayak, D. R. and Balakrishnan, R. 2010. *Ear, Nose, Throat and Head & Neck surgery; Clinical and practical*, 2nd ed. 317.
- [4] Kanani, A.; Schellenberg, R.; Warrington, R. 2011. Urticaria and angioedema. *Asthma and clinical immunology.* Allergy 7(1):1-10.
- [5] Wu, L. C. and Zarrin, A. A. 2014. The production and regulation of IgE by the immune system. *Nature Reviews Immunology*, 14: 247-259.
- [6] Kovalszki, A.; Sheikh, J. and Weller, P. F. 2013. Eosinophils and Eosinophilia. In *Clinical Immunology, principle & practice*, 4(2): 304.
- [7] Venge, P. 2004 Review article: Monitoring allergic inflammation. *Allergy*, 59: 26-32.
- [8] Hogan, S. P.; Rosenberg, H. F.; Moqbel, R.; Phipps, S.; Foster, P. S.; Lacy, P.; Kay, A. B. and Rothenberg, M. E. 2008. Eosinophils: Biological properties and role in health and disease. *Clin Exp Allergy*, 38: 709-750.
- [9] Rojelio, M. and Thomas, B. N. 2012. Evaluation and differential diagnosis of marked, persistent eosinophilia. *Semin Hematol*, 49(2): 149-159.
- [10] Trung, N.; Tran, D. B.; Khatri, K. e.; Christine, K. and Ward, D. G. 2014. High blood eosinophil count is associated with more frequent asthma attacks in asthma patients. *Annals of*

- allergy, Asthma & Immunology, Immunology, 1: 19-24.
- [11] Parveen, T.; Begum, N. and Begum, S. 2009. Allergen Skin Test Reactivity and Serum Total IgE Level in Adult Bronchial Asthmatic Patients. *J Bangladesh SocPhysiol*, 4(1): 1-6.
- [12] Chowdary, V. S.; Vinaykumar, E. C.; Rao, J. J.; Rao, R.; RamBabu, K. and Rangaman, V. 2003. A study on serum IgE and eosinophils in respiratory allergy patients. *Indian J Allergy Asthma Immunol.*, 17(1): 21-24.
- [13] Patel, A. K. and Nagpal, T. P. 2014. Comparison of blood absolute eosinophil count and nasal smear eosinophils with symptoms and severity of clinical score in patients with allergic rhinitis. *Indian J Allergy Asthma Immunol.*, 28(2): 74-77.
- [14] SAS. 2012. Statistical Analysis System, User's Guide. Statistical. Version 9.1th ed. SAS. Inst. Inc. Cary. N.C. USA.
- [15] Foley, S. and Hamid, Q. 2009. Immunopathology of Allergic Airway Inflammation. In: Middleton's iv Holgate ST, Simons FER; 7th ed, Mosby Elsevier Philadelphia, USA, 473.
- [16] Kindt, T. J.; Goldsby, R. A. and Osborne, B. A. 2007. Hypersensitivity Reactions. In *Kuby Immunology*, 6th ed. chapter 15: 371-375.
- [17] Kang, G.; Ju, Y. H.; Jung, J. H.; Ko, K. P.; Oh, D. K.; Kim, J. H.; Lim, D. H.; Kim, Y. H.; Jang, T. Y. and Kim, S. T. 2015. The Effect of PM10 on Allergy Symptoms in Allergic Rhinitis Patients During Spring Season. *Int J Environ Res Public Health*, (12): 735-45.
- [18] Scichilone, N.; Callari, A.; Augugliaro, G. Marchese, M.; Togias, A. and Bellia, V. 2011. The impact of age on prevalence of positive skin prick tests and specific IgE tests. *J Respir Med.*, 105(5): 651- 658.
- [19] AL-Yasiri, M. Y. K. 2014. Study some Immunological and Haematological changes upon workers of Vegetable Oils factory in Baghdad suffering from Hypersensitivity Type -1. MSc Thesis, Collage sciences for women. University of Baghdad. Iraq, pp.1-101.
- [20] Huang, S.; Vasquez, M. M.; Halonen, M.; Martinez, F. D. and Guerra, S. 2015. Asthma, airflow limitation and mortality risk in the general population. *EurRespir J.*, 45(2): 338-46.
- [21] Khan, M.; Khan, M.A.; Shabbir, F. and Rajput, T. A. 2013. Association of allergic rhinitis with gender and asthma. *J Ayub Med Coll Abbottabad*, 25(1-2): 120-2.
- [22] Pereira, P. R. and Lopes, C. 2013. A cross sectional assessment of allergic rhinitis and asthma control at an immunoallergy outpatient hospital setting using CARAT10 questionnaire. *Rev Port Pneumol.*, 19(4): 163-7.
- [23] Marinas, J. E. C. and Yeung, J. 2015. Chronic Spontaneous Urticaria and Omalizumab as an Emerging Therapy. *Int J ClinDermatol Res.*, 3(1): 45-49.
- [24] AL-Mousawi, M. H. A. 2009. Measurement of immunoglobulins and some hematological changes in acute and chronic urticaria. B.Sc thesis. University Baghdad, pp: 1-72.
- [25] Manohar, S. and Selvakumaran, R. 2012. Estimation of serum immunoglobulin E (IgE) level in allergic asthma and allergic rhinitis patients before and after treatment. *Euro. J. Exp. Bio.*, 2 (6): 2199-2205.
- [26] Söderström, L.; Lilja, G.; Borres, M. P. and Nilsson, C. 2011. An explorative study of low levels of allergen-specific IgE and clinical

- allergy symptoms during early childhood. *Allergy*,66(8):1058-64.
- [27] Al-Tae, K. S. C. 2003. Immunological and microbiological study for asthmatic patients. M.S.c thesis. AL-Mustansiriyah university college of science, Iraq, pp:1-184.
- [28] Yalcin, A. D. 2014. Advances in Anti-IgE Therapy. *BioMed Res Int.*, pp 1-11.
- [29] Kariyawasam, H. H. and Robinson, D. S. 2006. The eosinophil: the cell and its weapons, the cytokines, its locations. *Semin RespirCrit Care Med.*, 27: 117-27.
- [30] Walsh, E. R. and August, A. 2010. Eosinophils and allergic airway disease: there is more to the story. *Trends in Immunology*, 31: 39-44.
- [31] Jagadeeshwar, K.; Venumadhav, V.; Sangram, V.; Sathavahana, C. V.; Sudha, R. and Vinaykumar, E. C. 2012. A Study on serum IgE Levels, Peripheral Eosinophil and Individuals symptom's in patients with non-infective rhinitis and asthma and related conditions. *Int J Pharm Pharm Sci.*, 4(1): 88-92.

دراسة الكلوبولين المناعي الكلي وعد الخلايا الحمضة في أمراض الحساسية

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الخلاصة:

تهدف الدراسة الحالية الى تقييم مستوى الكلوبولين المناعي الكلي (E) والنسبة المئوية للخلايا الحمضة في بعض امراض الحساسية. تم جمع الكلوبولين المناعي الكلي (E) وكذلك النسبة المئوية للخلايا الحمضة ل 210 مريض (110 انثى، 100 ذكر) لمرضى حساسية (الربو التحسسي، التهاب الجيوب الانفية التحسسي، الشرى) أعمارهم ما بين (10-70) عام و50 شخص من الاصحاء أعمارهم ما بين 23-52 عام. أرتفعت معدلات مستويات الكلوبولين المناعي الكلي (E) معنويا $P < 0.05$ في مصل مرضى الربو التحسسي (503.54 ± 63.49) وحدة دولية/مل، التهاب الجيوب الانفية التحسسي (442.77 ± 95.76 وحدة دولية/مل) و الشرى (489.53 ± 69.68 وحدة دولية/مل) مقارنة مع مجموعة السيطرة (23.67 ± 5.81 وحدة دولية/مل)، وايضا كان هناك زيادة معنوية $P < 0.05$ في معدل النسبة المئوية للخلايا الحمضة في مرضى الربو التحسسي (4.37 ± 0.52 %)، التهاب الجيوب الانفية التحسسي (4.38 ± 0.50 %) و الشرى (4.12 ± 0.43 %) مقارنة مع مجموعة السيطرة (2.57 ± 0.86 %). معدل المستوى المصلي للكلوبولين المناعي الكلي (E) والنسبة المئوية للخلايا الحمضة في الدم يمكن ان تكون مفيدة في تشخيص امراض الحساسية.

الكلمات المفتاحية: الربو التحسسي، التهاب الجيوب الانفية التحسسي، الشرى، الكلوبولين المناعي الكلي (E)، الحمضات.