Sumer Journal for Pure Science (ISSN: 2790-7031)
SJPS 2024 (December), Vol. 3, No. 2, p.p. 48-57

A Comprehensive Comparison between Some Species of Mites That Cause Allergic Asthma

Bashayir N.Hasoon[1,*] , Talib A. Hussein[2], Suaad Almas Brakhas[3], Murad T.Mahmoud[4], Duha H salim[5] .

[1,2]*Department of Biology , College of Science for Women ,University of Baghda,Iraq.*
[3]*Department of Immunology-Allergy Specialized Center, Baghdad , Iraq.*
[4]*Public clinic, Baghdad medical city , ministry of health, Baghdad , Iraq.*
[5]*Department of Biology , College of Science for Women ,University of Baghdad,Iraq.*
*E-mail of corresponding author: bashayir.n@csw.uobaghdad.edu.iq

Abstract

A mite allergy is an allergic response to mites which often inhabit damp and dark environments. Signs of mite allergy include rhinitis such as sneezing, runny nose and asthma such as wheezing and difficulty breathing. The study was purposed to a comparison of a few mite species that cause allergic asthma. The increasing prevalence of respiratory allergy especially dust mite allergy in Iraq has caused climate change. The study was aimed to investigate some immunological and hematological in the patient suffering from dust mite and storage mite allergy. Mite allergy was diagnosed by Skin-prick test, intradermal test, and particular amount of IgE level. Individuals (90) blood sample was collected from Specialized allergy center and private laboratories ; Included (60) samples [female (36) , male (24)] from patients suffering allergic asthma of House Dust Mites ,their ages are between (15-50) years and(30)samples [female(18),male (12)] from patients suffering allergic asthma of storage mite , their ages are between (20-45) years . The number of apparently healthy control was (30) [females (16) and males (14)] their ages are between (22- 45) years. The Immunological factors were studied including assessment of serum interleukin IL-4 level, and total of serum IgE level. About season (35.00%) of storage mites increased in autumn and (55.00%) of house dust mites increased in winter. The environmental factors play as a trigger factor for emergence of respiratory allergies in Iraq brought on by storage and house dust mites. The season is major role for increasing dust mite allergy has confirmed the importance in the research.

Keywords: House Dust Mites ,Storage Mites ,Allergic Asthma, Interlukin-4

مقارنة شاملة بين بعض الأنواع من العث التي تسبب الربو التحسسي

بشائر ناصر حسون[1] , طالب عبدالله حسين[2], سعاد الماس برخس[3], مراد ثامر محمود[4], ضحى حميد سالم[5]

[1,2]قسم علوم الحياة ، كلية العلوم للبنات، جامعة بغداد، العراق
[3]قسم مركز المناعة والحساسية التخصصي، بغداد، العراق
[4]العيادة العامة، مدينة الطب ببغداد، وزارة الصحة، بغداد، العراق
[5]قسم علوم الحياة ، كلية العلوم للبنات، جامعة بغداد، العراق

الخلاصة

حساسية العث هي استجابة تحسسية للعث الذي غالبًا ما يعيش في بيئات رطبة ومظلمة. تشمل علامات حساسية العث التهاب الأنف مثل العطاس وسيلان الأنف والربو مثل الصفير وصعوبة التنفس. هدفت الدراسة إلى مقارنة عدد قليل من أنواع العث التي تسبب الربو التحسسي. تزايد انتشار حساسية الجهاز التنفسي وخاصة حساسية عث الغبار في العراق تسببت في تغير المناخ. هدفت الدراسة إلى تقصي بعض العوامل المناعية والدموية لدى المرضى الذين يعانون من حساسية عث الغبار وسوس التخزين. تم تشخيص حساسية العث عن طريق اختبار وخز الجلد، واختبار الأدمة، وكمية معينة من مستوى IgE. تم جمع (90) عينة دم من الأفراد من مركز الحساسية التخصصي والمختبرات الخاصة. شملت (60) عينة [أنثى (36)، ذكر (24)] من مرضى الربو التحسسي الناتج عن عث الغبار المنزلي وأعمارهم تتراوح بين (15-50) سنة و(30) عينة [أنثى (18)، ذكور (12))] من المرضى الذين يعانون من الربو التحسسي لسوسة التخزين وتتراوح أعمارهم بين (20-45) سنة. وبلغ عدد السيطرة ظاهرياً (30) [الإناث (16) والذكور (14)] وتتراوح أعمارهم بين (22 - 45) سنة. تمت دراسة العديد من العوامل المناعية بما في ذلك تقييم مستوى الإنترلوكين IL-4 في الدم، ومستوى IgE الكلي في المصل. وفي الموسم الحالي (35.00%) ازداد عث التخزين في فصل الخريف و(55.00%) من عث غبار المنزل في الشتاء. تلعب العوامل البيئية دوراً محفزاً لظهور حساسية الجهاز التنفسي في العراق الناجمة عن التخزين وعث الغبار المنزلي. وقد أكد هذا البحث أهمية الموسم في زيادة حساسية عث الغبار.

1. Introduction

Mite allergens has stimulate the innate and adaptive immune systems has been linked to the asthma allergy. The allergencity are the capacity to cause an allergic immune response. [1] , [2]. The inhalation of mite allergens in fecal pellets or mite bodies can result in mite allergy is an IgE-mediated type1 hypersensitivity response. House Dust Mites (HDMs) and Storage Mites are important sources of indoor allergens sensitization which produce and release into their environment [3].Mite allergy is associated with diseases such as allergic perennial rhinitis, allergic asthma and atopic dermatitis. House Dust Mites (HDMs) and Storage Mites are important sources of indoor allergens sensitization which produce and release into their environment; it is associated with diseases such as allergic asthma [4]. Mites is related to the family Pyroglyphidae, lives near vertebrates, and utilize the enzymes for digest debris of this near vertebrates. These enzymes were secreted in the fecal pellets of mites [5], [6]. The sources of allergens that cause sensitization about (15–20%) industrialized countries population .The relative humidity, temperature and other environmental factors affect the distribution of HDM species and the distribution of these species varies between dark regions [7] . Mites are eight legged arthropods ,very small ,oval shape, creamy to white color bodies, and invisible to the naked eye can be easily seen under a low energy microscope at (20x-80x) magnification [8], [9].

House Dust Mites accumulate in the house dust, skin peeled human or pets, and colonized with bacteria, fungi, and yeast [10]. Dust mites are light sensitive, live within dark humidity place soft substrates, like mattresses, pillows , and carpets .Thousands of mites have been discovered in only one gram of home dust [11].There are (10,000) species of dust mites according to taxonomy, which are categorized into several suborders, families, and genera. These mites are free-living and have a variety of environments. Few of mites species are related to taxonomy a stigmata that produce allergens that have a major role for induce specific IgE for mediated allergic reactions of individuals who are sensitive to mites allergen [12].The family Pyroglyphidae has sixteen genera and forty-six species, at least thirteen of which have been discovered in household dust. Dermatophagoides pteronyssinus , Dermatophagoides farina, and Euroglyphus maynei , are including (80% - 90%) of house dust mites .Blomia tropicalis, and Glycyphagus domesticus , are a storage dust mite live in tropical, and subtropical regions [13].

2. Material and Methods

2.1 Clinical Examination

The information about patients was recorded of allergic disease. This questionnaire' form demographic contained information (name, gender, age, and family history, taking drugs for allergy or not, taking vaccine for mite allergy or not, address of work and house, smoking or not, and if patients have other diseases) [14].Chest X-Ray (CXR) chest was shown a picture chest of lungs used for diagnosing allergic asthma [15].

2.2 Chest X-Ray (CXR) Test

Chest radiography used for tow group patients such as extra thoracic and systemic disorders that primarily affect the chest, patients were diagnosed by screening test for taking a photographic or digital image of the structures inside body for chest [15].

2.3 Pulmonary Function Test (PFT)

Spirometry mechanics used for measurements of Forced Vital Capacity (FVC) , Forced Expiratory Volume (FEV_1) , Forced Expiratory Flow (FEF) values, Forced Inspiratory Flow Rates(FIFs),and Maximum Voluntary Ventilation (MVV) . Used to identify the severity of pulmonary measure and how lungs work [15].

2.4 Sample Collection

The case studies included 120 samples (patients and healthy control). mites allergy samples were attended and collected from Specialized allergy center and private laboratories , the age of patients are between 35-50 years .Blood sample were recruited during the year 2023. Blood was obtained from each subject and left to coagulate at room temperature for approximately 15 min. It was then separated for 5 min.by centrifugation [16].These cases were diagnosed according to medical history, Symptoms and the presence of positive intradermal skin test to storage mite allergen *Glycyphagus domesticus* and presence of positive Skin-Prick Test (SPT) to House Dust Mite (HDM) allergen *Dermatophagoides Pteronyssinus*, *Dermatophagoides farina*.

The study groups involved :
Group 1: the sample group comprised of (30) patient samples with allergic asthma for both storage mites (*G.domesticus*) in age ranging from 20 to 45 years old, with 12 men and 18 women of each gender.

Group 2: the sample group comprised of (30) patient samples with allergic asthma for house dust mites (D.*Farina*), in age range of 20–45 years, including 10 men and 20 women of each gender.

Group 3: the sample group comprised of (30) patient samples with allergic asthma for house dust mites (D. *pteronyssinus*) in age range of 20–45 years, including 10 men and 20 women of each gender.

Group 4: the control group comprised of (30) Apparently Healthy Control (AHC) individuals without allergic symptoms or other diseases, age range of 22 to 45 years, including 14 men and 16 females in each gender.

Figure-1 This figure depicts the Intradermal Kit

2.5 Laboratory Examination

Hematological analysis was applied in WBC differential count by hematological auto analyzer and manual eosinophil count % by using leishman stain. Immunological test involved two parameters that related to allergic disease; total of IgE level and Interleukins (IL-4).

2.6 Eosinophil and WBC Count

Whole blood sample collected in EDTA tube, manual Eosinophil count % analyzed by using hematological auto analyzer\ Mindray Global and leishman stain.

2.7 Statistical Analysis

The impact of various components in the research parameters was examined using the SAS (2012) statistical analysis system tool. In this study, the means were compared statistically using the Least Significant Difference (LSD) test **[17]**.The group of patient divided in three for mites allergy , Table(1) show the immunological and hematological parameter .

(a) (b)

Figure –2 This figure depicts the Result of test (a) Intradermal Test. (b) Skin Prick Test

4. Results

A parent's asthma, a childhood history of severe respiratory infections, an allergy, or occupational exposure to certain chemical irritants or industrial dusts is the most prevalent causes of getting asthma. The outcomes in the groups under study in relation to the gender, show the percentage of female is higher than male in each group and there are high significant difference between a group ($P<0.01$), Other studies found that allergic asthma in females is (84.09%) which is higher than in males (15.90%) which were recorded by (Wahaab, 2013). The study of [18]showed that in allergic disease the number of female patients (243) was higher than male (148). Female gender is seems an independent risk factor for severe asthma [19].The Hormones in females are involved high impacts of AA.They affected about (forty percent) in females. They because a much of impacts as triggers like (Allergen), and the frequency of Levels may be related to the estrogen hormone are due to respiratory inflammation. Allergic Asthma attacks females before menstruation period, especially when the estrogen being few. The emergency hospitalization is more common in women and they need more time of hospital stay than men [20].

Table 1- Hematological and immunological test for groups with p- value

Tests	Storage mites (30)N	House Dust Mites (60)N		Control (30)N	P-value
Species of Mites	*G. domesticus* Mean	*P. pteronyssinus* Mean	*P. Farina* Mean	Mean	
Medical history +	5 (14.33%)	16 (52.33%)	26 (86.67)	14 (46.67%)	** (P≤0.01).
–	27 (87.67)	14 (45.67%)	4 (13.33%)	16 (53.33%)	
Hb	13.87 ±0.21	12.93 ±0.27	12.79 ±0.45	11.79 ±0.45	(P<0.05)
Wbc count	7913.33 ±287.82	7559.33±408.69	6020.00±322.86	3020.00±322.86	(P<0.01)
Eosinophil count	6.03 ± 0.32	5.93 ± 0.36	2.40 ± 0.17	1.40 ± 0.17	(P<0.01)
IgE	304.64 ± 29.51	253.91 ± 31.03	48.92 ± 3.27	45.92 ± 3.27	(P<0.01)
IL-4	38.14 ± 4.63	13.70 ± 3.18	6.77 ± 0.96	5.77 ± 0.96	(p<0.01)

Note: ** mean highly significant (P≤0.01) and (P<0.05) mean Significant.

The result showed the allergic severity of asthma which increase in age between (30-45) years ,this result may be related to genetic factors that occurred in this age , risks of AA were associated in (≥45) years of individual patients in Mild, and moderate Allergic Asthma (AA), and not found AA in severity state. The exacerbation based in AA severity which suggested that Individuals with moderate asthma should pay more attention to their age and co-morbidities, whereas those with severe asthma should pay more attention to their hospitalization history [21].The results of family history about allergic asthma play major role .

In studies of [22], [23], [24] recorded that the family history of atopy played role as risk factor for allergic disease [25], [26] recorded that relation between groups.

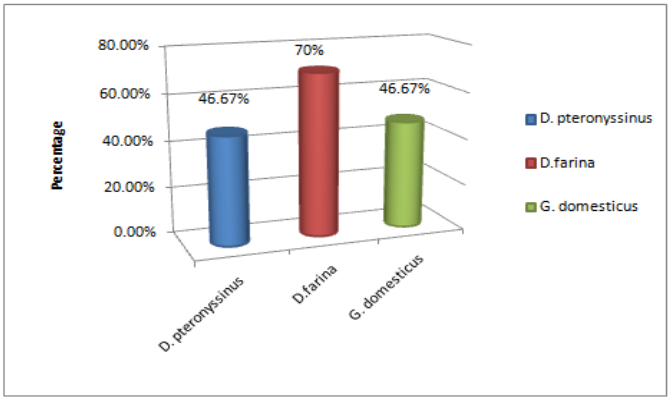

Figure -3 Distribution of allergens based on storage and house dust mites in a sample study

5. Discussion

The positive Skin Prick test for D. *pteronyssinus*, (46.67%) , D. farina (70.00%) while G. *domesticus* positive Intradermal skin test (47.67%) about season (35.00%) of storage mites increased in autumn and (55.00%) of house dust mites increased in winter. genetic predisposition, the environmental factors play a role for mites allergy disease and this is in agreement with [27].The WBC count was compared with the study groups' findings. Between them, there are extremely significant differences ($P<0.01$). as shown in table (1). When an allergic reaction occurs, the WBC count, eosinophils, and basophils rise. The number of white blood cells is thought to be a crucial component of cells that might produce large amounts of histamine, particularly in conditions affecting the airways. Therefore, a greater WBC count is a sign that is connected to histamine and other inflammatory indicators [28].The groups under investigation differ significantly from one another ($P<0.01$). Airway disease was characterized when Eosinophil cells occurred . Eosinophil Level increased in Rhino Conjunctivitis (hayfever) , AA showed an increase in Eosinophil cells % in blood. In addition to [29], [30] , [31] who showed the Eosinophil Cell Count (%) in allergic asthma.Total IgE levels are elevated in many allergic diseases and parasite infections, for example patients with atopic disease, allergic rhinitis, allergic asthma, food allergy and eczema, and it is important in diagnosis of allergy and gives additional information compared to asking patients if they have any allergic disease . evidence that allergic disorders are associated with elevated blood IgE levels. .Interleukin -4 agene is known to regulate IgE production [32].The fact that total and specific IgE levels in the blood are higher in patients with allergic and non-allergic asthma and that there is a negative correlation between IgE levels and lung function suggests the role of IgE, it is associated with lymphocyte T cell type 2. There has long been .This result is in agreement with [33] about the increase of IL-4 in allergic asthma with highly significant difference between studied groups. [34], [35] showed the difference in serum IL-4 levels between patients and control group. Highly Significance increased of serum interleukin- 4 in group ($p < 0.001$). A key cytokine in the development of allergic inflammation is interleukin (IL)-4. It is connected to B lymphocytes secreting IgE and inducing the isotype switch. Thus, the emergence of allergy illness is linked to an increase in IL-4 levels.

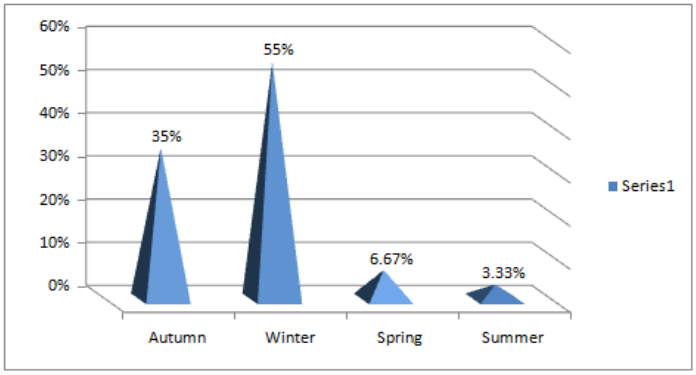

Figure -4 Seasonal variations in the allergen distribution caused by mites in the sample study

The result about seasons of onset disease showed that the percentage of house dust mites increased in winter. [27] showed seasonal and environmental variations in the commusnity structure of HDM, and founded HDM in the coldest seasons: winter, followed by autumn and spring with higher HDM concentrations in curtains and mattresses. A likely explanation for these results is the fact that winter is wetter than summer in our study region. In summer, rise in temperature causes more evapotranspiration, making it unfavourable for the development of mites. In the wetter winter, on the other hand, humid indoor conditions and the presence of woollen blankets and clothes promote a favourable environment for HDM development. Indeed, indoor humidity conditions are the main limiting ecological factor to the presence and distribution of mites [36] In addition to genetic predisposition, the environmental factors play a role for mites allergy disease and this is in agreement with (Nascimento et al., 2017).

6. Conclusion

Finally, the role of environmental variables as a precipitant in the onset of respiratory allergies, The location and season play a significant influence in respiratory diseases. Storage Mites and House Dust Mite are found in a humidity environment in a dark place with dust, and it is very dangerous for the respiratory system.It has the potential to progress from a moderate to a severe ailment and result in chronic allergic asthma if medicine or vaccination is not administered. Dust mite allergies are often treated with over-the-counter decongestants and antihistamines. Symptoms of sneezing, runny nose, and itching can all be relieved with these solutions. To facilitate breathing, they also reduce inflammatory tissues. A single gram of pet food or cereal might have thousands of storage mites in it. Pantries, kitchen cabinets, and dust are some places where storage mites can be discovered. The primary transporter of indoor pollutants is dust, particularly bacteria and allergens from dust mites, which can cause eczema, rhinitis, asthma, and other allergic reactions. although dust mite allergen concentrations in various types of dust have an impact on the relative abundance of bacteria, it is unclear how this relationship changes, which is crucial information for determining the health risks associated with dust mites.

7. Recommendations and suggestions

It is recommended to prepare a vaccine that is currently in progress, specific to the type of storage mite, prepared in different concentrations. , it is preferable to start the first doses with high concentrations because it reduces the severity of symptoms, especially in children, as many infections have been found in children in Karkh allergy centers. recommended for a genetic polymorphism study to find out the genetic influence and medical history that increases allergy in addition to environmental factors. It is recommended that workers in offices and storage grains take the vaccine because these places are highly susceptible to the presence of storage mites, in addition to avoiding humidity and exposing clothes and pillows to sunlight.

Acknowledgments

Many thanks to the following departments for helping with the practice side of this article:College of Agriculture, Department11 of Biology, College of Science1 for Women University of Baghdad, and Specialized allergy center. Finally Acknowledgments to Al-Karkh and Rusafa Allergy Center in Baghdad for help to collect samples and data for research.

8. References

[1] A. &. R. C. Jacquet, "Proteolytic, lipidergic and polysaccharide molecular recognition shape innate responses to house dust mite allergens.," *Allergy*, vol. 75, no. 1, pp. 33-53, 2020. https://doi.org/10.1111/all.13940

[2] Huey-Jy Huang, Yvonne Resch-Marat, Anne Casset, Margit Weghofer, "IgE recognition of the house dust mite allergen Der p 37 is associated with asthma.," *Journal of Allergy and Clinical Immunology*, vol. 149, no. 3, pp. 1031-1043, 2022. https://doi.org/10.1016/j.jaci.2021.07.040

[3] D. E. D. S. G. L. D. N. J. M. &. F. N. J. Silva, "Mite fauna associated with bird nests in Southern Brazil.," *Systematic and Applied Acarology*, vol. 23, no. 3, pp. 426-440, 2018. https://doi.org/10.11158/saa.23.3.2

[4] Calderón, M. A., Linneberg, A., Kleine-Tebbe, J., De Blay, F., Hernandez Fernandez De Rojas, D., Virchow, J. C., & Demoly, P, "Respiratory allergy caused by house dust mites: what do we really know?.," *Journal of Allergy and Clinical Immunology*, vol. 136, no. 1, pp. 38-48, 2015. https://doi. 10.1016/j.jaci.2014.10.012

[5] Kmov, P. B., & Oconnor, B, "Is permanent parasitism reversible?—Critical evidence from early evolution of house dust mites.," *Systematic biology*, vol. 62, no. 3, pp. 411-423, 2013. DOI: 10.1093/sysbio/syt008

[6] Jacquet, A, "Innate immune responses in house dust mite allergy.," vol. 2013, no. 1, p. 735031, 2013. https://doi.org/10.1155/2013/735031

[7] H. J. S. E. &. V. S. Huang, "House dust mite allergy: The importance of house dust mite allergens for diagnosis and immunotherapy.," *Molecular immunology*, vol. 158, pp. 54-67, 2023. DOI: 10.1016/j.molimm.2023.04.008

[8] Wharton, G. W, "Mites and commercial extracts of house dust.," *Science*, vol. 167, no. 3923, pp. 1382-1383, 1970.

[9] Platts-Mills, T. A. E., de Weck, A. L., Aalberse, R. C., Bessot, J. C., Bjorksten, B., Bischoff, E., Wen, T Platts-Mills, "Dust mite allergens and asthma—a worldwide problem.," *Journal of Allergy and Clinical Immunology*, vol. 83, no. 2, pp. 416-427, 1989. https://doi.org/10.1111/all.15553

[10] Fletcher, A. M., Pickering, C. A. C., Custovic, A., Simpson, J., Kennaugh, J., & Woodcock, A, "Reduction in humidity as a method of controlling mites and mite allergens: the use of mechanical ventilation in British domestic dwellings," *Clinical & Experimental Allergy*, vol. 26, no. 9, pp. 1051-1056, 1996. https://doi.org/10.1111/j.1365-2222.1996.tb00643.x

[11] Arlian, L. G., Bernstein, D., Bernstein, I. L., Friedman, S., Grant, A., Lieberman, P., and Zeiger, R. S., "Prevalence of dust mites in the homes of people with asthma living in

eight different geographic areas of the United States.," *Journal of Allergy and Clinical Immunology*, vol. 90, no. 3, pp. 292-300, 1992. doi: 10.1111/j.1600-0668.2008.00578.x

[12] T. O. S. I. T. &. S. S. Miyamoto, "Allergenic identity between the common floor mite (Dermatophagoides farinae Hughes, 1961) and house dust as a causative antigen in bronchial asthma.," *Journal of Allergy*, vol. 42, no. 1, pp. 14-28, 1968. DOI: 10.1016/0021-8707(68)90128-7

[13] Blythe, M. E., Williams, J. D., & Smith, J. M., "Distribution of pyroglyphid mites in Birmingham with particular reference to Euroglyphus maynei.," *Clinical & Experimental Allergy*, vol. 4, no. 1, pp. 25-33, 1974. https://doi.org/10.1159/000381854

[14] Noor Ulhuda G. Mohammed, Fayhaa M. Khaleel, "The role of serum chitinase-3-like 1 protein (YKL-40) level and its correlation with proinflammatory cytokine in patients with rheumatoid arthritis.," *Baghdad Science Journal*, vol. 19, no. 5, pp. 1014-1014., 2022. https://doi.org/10.21123/bsj.2022.6293

[15] Saied, M., Gewily, E., Husseini, M. El, Beshir, S., Elserougy, S., Hafez, S. F., & Hamshary, M. S. El, "Diagnosis of occupational asthma in flour mills at South Cairo.," *Egyptian Journal of Community Medicine*, vol. 36, no. 1, 2018.

[16] *Raghad K. Mwafaq, Amal K. Abbas,etal*, "The immunohistochemically estimation of CD63 in Iraqi patients with gastric cancer.," *Baghdad Science Journal*, vol. 19, no. 5, pp. 0932-0932, 2022. DOI: 10.37934/arfmts.116.2.2740

[17] N. Cary, "Statistical analysis system, User's guide. Statistical.Version 9. SAS.," *Inst. Inc. USA.*, 2012.

[18] Alwan ,A.H. and AL-Dulaimy, "Study of skin sensitivity to various allergens by prick skin test in patients with bronchial asthma.," *Diyala Journal of Medicine*, vol. 1, no. 2, pp. 78-82, 2011.

[19] McCallister, J. W., Holbrook, J., Wei, C. Y., & Mastronarde, J. G., "Sex differences in asthma symptom profiles and control assessment. In C33.CLINICAL PROFILES AND SEVERITY OF ASTHMA," *American Thoracic Society.*, pp. pp. A4309-A4309, 2011. doi: 10.1016/j.rmed.2013.07.024

[20] B. B. R. D. M. H. M. J. L. K. A. R. .. &. S. G. Jany, "Expertentreffen COPD: Lunge und Herz–ziemlich oft gemeinsam krank!.," *Pneumologie*, vol. 73, no. 11, pp. 651-669., 2019. DOI: 10.1055/a-0914-9566

[21] Kang, H.-R., Song, H. J., Nam, J. H., Hong, S.-H., Yang, S.-Y., Ju, S., and Lee, E.-K., "Risk factors of asthma exacerbation based on asthma severity: a nationwide population-based observational study in South Korea.," *BMJ open*, vol. 8, no. 3, p. e020825., 2018. https://doi.org/10.1136/bmjopen-2017-020825

[22] Sokolovski, B. "709 Atopic Dermatitis and Family History of Allergic Diseases in Asthmatic and No Asthmatic Children.," *Pediatric Research*, vol. 68, no. 1, pp. 360-360, 2010. https://doi.org/10.4168/aair.2015.7.2.101

[23] Alm, B.; Goksor, E.; Aberg, N.; Mollborg, P.; Pettersson, R.; Erdes, L. and Wennergren, G., "PD12-Living on a farm protects from allergic rhinitis at school age.," *Clinical and Translational Allergy*, vol. 4, pp. 1-1, 2014. https://doi.org/10.1186/2045-7022-4-S1-P12

[24] Baccioglu, A.; Sogut, A.; Kilik, O. and Beyhun, E., "The prevalence of allergic diseases and associated risk factors in school-age children and adults in Erzurum, Turkey.," *Turkish thoracic journal*, vol. 16, no. 2, p. 68, 2015. doi: 10.5152/ttd.2015.4229

[25] A. F. H. H. R. M. T. A. &. A.-A. A. M. Hussain, "An annotated bibliography of medical mycology in Iraq: 1962-2021.," *Microbial Biosystems*, vol. 6, no. 1, pp. 11-31., 2021.

[26] M. AL-Janabi, S. AL-Hammash, N. Waill and M. a. N. N. Shebab, "Rick factors of bronchial asthma in children: A hospital based study.," *The Iraqi Postgraduate Medical Journal*, vol. 9, no. 1, pp. 6-9, 2010.

[27] Nascimento, J. M., Reis-Avila, G., Dutra, M. S., Silva, D. E., Castro, L. C. d., & Ferla, N. J, "Seasonal and environmental variations in community structure of house dust mites (Acari) in subtropical southern Brazil.," *International journal of acarology*, vol. 43, no. 1, pp. 86-90, 2017. DOI: 10.1093/jme/tjx239

[28] Ava, D. ; Wasima, J., "A study of the hematological profile in relation to some allergic diseases (a hospital based study).," *Int J Basic Appl Physiol*, vol. 2, no. 1, pp. 35-40, 2013.

[29] Dhar , S.;Malakar ,R.;Chattopadhyay ,S.;Banerjee, R. and Ghosh ,A "Correlation of the severity of atopic dermatitis with absolute eosinophil counts in peripheral blood and serum IgE levels.," *Indian Journal of Dermatology, Venereology and Leprology*, vol. 71, p. 246., 2005. doi: 10.4103/0378-6323.16615

[30] Takahashi, A. ; Konno, S. ; Isada, A. ; Hattori, T. ; Shimizu, K. ; Shimizu, K. ; Taniguchi, N. ; Takahashi, D.; Taniguchi, M. ; Akazawa, A. ; Hizawa, N. and Nishimura, M "Evaluating total serum IgE levels and peripheral eosinophil count in asthma and rhinitis.," *Arerugi=[Allergy]*, vol. 59, no. 5, pp. 536-544., 2010.

[31] Vosooghi, S.; Mahmoudabady, M.; Neamati, A.; and Aghababa, H, "Preventive effects of hydroalcoholic extract of saffron on hematological parameters of experimental asthmatic rats.," *Avicenna journal of phytomedicine*, vol. 3, no. 3, p. 279., 2013.

[32] Reithofer, M., & Jahn-Schmid, B., "Allergens with protease activity from house dust mites.," *International journal of molecular sciences*, vol. 18, no. 7, p. 1368, 2017.

[33] Medina,C. O. "Tissue-Resident Memory Tr1 Cells, Interleukin-10, and the Extracellular Matrix in Airway Inflammation.," *Stanford University.*, 2020.

[34] Attwa, E., & Sheikh, A. R. El. "Arg551 interleukin-4 receptor α allele and atopic dermatitis.," *Egyptian Dermatology Online Journal*, vol. 2, no. 1, p. 1, 2006. doi: 10.2147/ITT.S260370

[35] Wahhab, R.S, "Investigate Role of IL-17 and Its Relationship Some Immunological Indicators and Severity in Patients of Allergic Asthma.," *AL-Mustansiriya University, College of Basic Education.*, 2013.

[36] König, K., Klemens, C., Eder, K., San Nicoló, M., Becker, S., Kramer, M. F., & Gröger, M."Cytokine profiles in nasal fluid of patients with seasonal or persistent allergic rhinitis.," *Allergy, Asthma & Clinical Immunology*, pp. 1, 1-10,2015.