Canadian Journal of Medical Research

Allergens sensitization and Allergy modes among atopic diseases in Basrah province through 2021-2022

Ihsan Edan Alsaimay,[1] Falih Hmood Mezban,[2] Hasan lateef jasim,[3] Abbas abduljabbar jerri [3] Israariyadh amer [3]

[1]Department of microbiology, College of medicine, University of Basrah; [2]Center of allergy and asthma diseases, Basrah, Iraq
[3]Third stage students, College of medicine, University of Basrah, Iraq
Correspondence to: Ihsan Edan Alsaimay, Department of microbiology, College of medicine, University of Basrah, Iraq
Email: Ihsan.alsaimary@uobasrah.edu.iq
Received: Jan 3, 2022, Accepted: April 14, 2022, Published: May 2, 2022; CJMR 2022, 1(1)

Abstract

Purpose: Atopic diseases are group of diseases which are very common in population and occur in all ages include Allergic rhinitis, Bronchial asthma, and Atopic dermatitis.

Aims: To determine allergens sensitization of atopic diseases in Basrah population through two years (2021 -2022).

Method: Estimation of allergic status for 234 patients which admitted to the health center and determine allergens sensitization by polycheck technique.

Results: Number and percentage of patient with atopic diseases were determined in this study, the age group 21_30 years records high percentage (26.50%) in male and female respecting with high significant difference P≤0.01 (p= 0.0492) The majority of atopic diseases was for age group 21_30 years for both sexes, reached 27.36% for male and 25.78% for female respectively with high significant difference P≤ 0.01(p= 0.0431 for male, p=0.0462 for female). The results shows that 55(23.5%) of patients both male and female with Allergic rhinitis , 99 (42%) of the patients with Bronchial asthma and 80 (34.19) of patients with Atopic dermatitis with no significant different (p= 0.176) for both sexes The age group 21_30 years recorded highly percentage for male and female respectively in comparison with other age groups.

Introduction

Atopic disease associated with chronic systemic inflammation (Czarnowicki, et al.,2015). Multiple comorbid chronic health problems, including disrupted sleep (Brickman, et,.2014). Hypertension and cardiovascular isolation, (Zhang and Silverberg, 2015), obesity (Silverberg, 2015). (Juhn, 2014) Warts and extra cutaneous diseases, and depression, anxiety, and various other psychiatric comorbidities. (Yaghmaie, et al., 2013). There is greater risk of low bone mineral density in some patients with atopic disease (i.e. bronchial asthma, allergy rhinitis, dermatitis. (Li, et al., 2015).

Bronchial asthma has been recognized as a significant health condition (Jackson and Staffort, 2009). The etiological origins of asthma frequently vary between disease carriers; for this reason, asthma has suggested better identified in terms of its physical symptoms rather than its cause (Boehlke, et al., 2014). Usually considered from a clinical point of view to consist of one or more of the following presented in acute attack: chest tightness, wheezing, shortness of breath and cough (Currie and Baker, 2012).

Allergy rhinitis is allergic sensitization to airborne allergens for instance; allergic sensitization usually systemic, the site of exposure to the sensitized allergen is typically localized to allergic disease. When antigen-presenting cells ingest allergens and present them to naive T cells, the sensitization begins in the mucosa. T cells divide into Th2 cells and cause naïve B cells to shift and become B cells and memory B cells that generate IgE. Immunological responses are caused by IgE-mediated reactions to harmless antigens or allergens and cause acute allergic symptoms, such as rhinitis (Borres, M.P., MEbisawa, and P.A Eigenmann, 2011). Dermatitis it is skin allergen reactivity. Interestingly, IgE detects very small

quantities of antigen, making it a "gatekeeper," as foreign particles are first identified in areas of interface with the setting. When these foreign particles, such as pollen, cat dander or peanut proteins, are harmless, IgE transitions from beneficial to life-like. Threatening IgE mediates allergic responses, such as atopic dermatitis. (Larché, Akdis, and Valenta, 2006).

The study aim is to determine the most common sensitizing aeroallergen in the patients with skin allergies in Basrah city through 2021 and 2022.

Material and Methods

Study Population

Retrospective study to two hundreds thirty four patients attending to center of allergy, asthma diseases and dermatitis in Basrah city who had skin allergies with their age range from (one day – above 60 years) were included in study. The study performed during the period from 2021 to 2022.

Poly Check Test

Test Performance

A. To start the assay: all components were tested at room temperature and are mixed well.

B. Reagents lots provided with the actual kit were used only.

C. Powder wash buffer has to be diluted with demineralized water at least 30 minutes prior to use avoid foaming.

D. The membranes of the test cassettes shouldn't dry during the assay.

E. All incubation steps are performed at room temperature (18-24 c) and with constant shaking.

F. A flatbed scanner with CCD sensor and scanning resolution of 600 DPI was used for interpretation of the test result.

G. Performance was tested by automated system additional information sheets are available.

A sufficient number of polycheck allergy cassettes was prepared and mark them-only on the long side of the cassette.

The cassettes were moisture with 1 ml wash buffers, by tapping upside-down on absorbent paper.

Overlay allergy cassettes with 250 micro liter of polycheck start solution (blue cap)and incubate for 60 seconds (always pipette into the gap).Tap the cassettes carefully upside-down on absorbent paper.

A 200 micro liters of the respective patients serum was add into the cassette and incubate for 60 minutes on a shaker place the MTP-holder on the middle of shaker.

A 3 times was decanted and washed with 1ml of polycheck wash buffer. Tap the cassettes carefully upside-down on absorbent paper.

A 250 micro liters was adding wash buffer and incubate for 5 minutes on a shaker.

Repeat step 5 Decant and tap the cassettes carefully.

A 250 micro liter of polycheck anti-IgE antibody was pipeted and incubated for 45 minutes on shaker. Decant and wash 3 times with 1 ml wash buffer. Tap the cassettes carefully on absorbent paper.

A 250 micro liters polycheck enzyme –labeled anti-ligand was add and incubated for 20 minutes on shaker .decant and wash as described in 7. Tap the cassettes carefully on absorbent paper.

A 250 micro liter of polycheck substrate solution was added. and incubated for 20 minutes in the dark .decant and wash as described in 7.

Air drays the membrane and evaluates the polycheck allergy cassettes using scanner and the Biocheck imaging software Fig.1

Fig. 1: Mini Rocker-Shaker

Table 1: Polycheck®-Kit Components (Biocheck Gmbh.Germany)

Components	Content	Preparation	Store at	Shelf Life
Polycheck® Allergy Cassettes	24 (12) Cassettes	ready to use	2 – 8 °C with desiccant in a sealed plastic bag	see expiry date
Start Solution Buffered protein solution	Manual: 2 (1) x 3.5 ml Automat: 1 x 10 ml	ready to use	2 – 8 °C	see expiry date
Anti-IgE Antibody Monoclonal (murine) Antibody labelled with ligand	Manual: 2 (1) x 3.5 ml Automat: 1 x 10 ml	ready to use	2 – 8 °C	see expiry date
Enzyme-Labelled Anti-Ligand Ligand conjugated to alkaline phosphatase	Manual: 2 (1) x 3.5 ml Automat: 1 x 10 ml	ready to use	2 – 8 °C	see expiry date
Substrate Solution 5‘bromo-4‘chloro-3‘ indolylphosphate and 4‘ nitroblue tetrazolium, buffered	Manual: 2 (1) x 3.5 ml Automat: 1 x 10 ml	ready to use	2 – 8 °C protect from light	see expiry date
Wash Buffer Phosphate Buffer, pH 7.4	2 (1) pouches	dissolve in 1 liter demineralised water	2 – 8 °C avoid foaming	30 days after dissolving; until the expiry date,

Results and Discussion

According to their residence, the distribution of atopic diseases patients in this study revealed that atopic disease was more prevalent in Central areas(40.7%) than peripheral areas(29.3%) as shown in table.2 .Similar result was also produced by (Kilpelainen et al., 2000), the farm environment reduce risk of atopic disease in young adults

in the presence or absence of family history of, besides people who lived in Central areas are in continuous and direct exposure to air pollution on a daily basis and were more likely to develop atopic disease. (Eseverri et al., 1998). Studied the risk factors for development of asthma and among these risk factors; he found that all of the patients were from central areas.

Sensitization to pollen was higher in central areas than peripheral areas despite pollen counts are higher in peripheral areas and this can be due to development of immunological tolerance to pollen allergens in peripheral areas or due to adjuvant effects of central pollution.(Riedles, et al., 2000) found out that exposure to stables and/or farm milk is protective only if prior to one year of age and so if the mother exposes to these factors during pregnancy, also it could be due to many factors, breast feeding, lack of immunization, in addition to the exposure to the products of milk. Laboratory animal studies indicated that air pollutants make mucus membranes of airways tracts become more permeable, leading to the development of allergic reactions.(Kauffman et al.,2002). found out that IgE levels are significantly lower in those who permanently live in the country and in particular in those who live for > or = 10 years, in addition, positive skin prick tests (SPT) were significantly less prevalent in those who permanently lived in the country. (Majeed et al., 2008). found out that most of the asthmatic children lived in the central areas of Hyderabad.

Table 2: Distribution of atopic diseases according to gender and residency

Gender	**Residency**					
	Central		**Peripheral**		**Total**	**Percentage**
	Number	**Percentage**	**Number**	**Percentage**		
Male	63	46.3	43	43.8	196.1	45.30
Female	73	53.7	55	56.1	237.8	54.70
Total	136	40.7	98	29.3	234	100
Probability	Value (p) = 0.0862	-	-	-	Not Significant	-

Table 3: Distribution of a topic diseases for both gender according to various age groups

	Male		Female		Total	
Age group	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
1 Day <2 Years	0	0	0	0	0	0
2- 10 Y	7	6.60	11	8.59	18	8
11- 20 Y	17	16.04	24	18.75	41	17. 52
21- 30 Y	29	27.36	33	25.78	62	26.50
31- 40 Y	23	21.70	26	20.31	49	20.94
41- 50 Y	16	15.09	18	14.06	34	14.53
51- 60 Y	9	8.49	8	6.25	17	7.26
Above 60 Y	5	4.72	8	6.25	13	5.56
Total	106	45.30	128	54.70	234	100

Statistical Probability	0.0431	Significant	0.0462	Significant	0.0492	-

The statistical analysis showed no highly significant differences between male and females, according to the total percentages of allergic diseases for various age groups (P>0.01) The table showed that the highly allergic disease was in the age group 21-30 yrs (62 patients in percentage %) while other age groups :

Less than 2 years 0%

- 2-10 yrs 8%
- 11-20 yrs 12.52%
- 21-30 yrs 26.50%
- 31-40 yrs 20.94%
- 41-50 yrs 14.53 %
- 51-60 yrs 7.26%
- Above 60 yrs 5.56%

Table (3) showed the mean ages. There was no substantial difference between the groups in terms of ages.0.The patient's age range was (2 and > 60) years and this was consistent with most AI research, such as (Creticos, et al., 1996).Regarding the age group, the highest percentage (26.5 %) was (21-30) years old and the lowest percentage (5.5 %) was (above 60) years old. The researcher suggests that this outcome could have shown higher prevalence of bronchial asthma in individuals from 21-30 years old. (Hassan, 2009) endorsed this outcome. Females were more affected than males as shown in table (2). The percentage of females was(54.7%), where as that of male was(45.3%).Throughout data analysis, the majority (54.7%) were females, this indicates in majority of studies that atopic diseases incidence were in females more than in males. Prolong exposure to allergic irritant in work places or due to hormonal change between men and women. This agrees with study of (Maddox and Schwartz, 2002) which stated that women aged 40 years have greater prevalence of asthma of the same age group (Mingomataj et al., 2008). Found that the percentage of females was (62.6 %) while that of male was (37.4 %).This sex difference may be due to female sex hormones.

Table 4: Occurrence of various types of atopic diseases according to gender

Atopic Diseases								
Gender	**Allergic Rhinitis**		**Bronchial Asthma**		**Atopic Dermatitis**		**Total**	
	Number	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**	**Number**	**Percentage**
Male	28	26.42	41	38.68	37	33.94	106	45.30
Female	27	21.09	58	45.31	43	33.59	128	54.70

Total	55	23.50	99	42.31	80	34.19	234	100
Probability Value (p)	0.176	-	Not Significant	-	-	-	-	-

Table.4 showed the analysis revealed a high percentage (57.69%) of the study samples of other allergies not present (42.31 %) from samples of other allergies present because the researcher assumes this finding is attributable to experience of asthma patients who are subjected to continuous weeklyTreatment at the Basrah Allergy and Asthma Center . Hong,et al, did not confirm these outcomes (2012).

Table 5: Distribution of atopic diseases according to various allergens in each gender

Atopic Diseases	Gender	Allergens																							
		D1	D2	D201	M1	M2	M3	M5	M6	F95	G2	GX7	F49	FX77	F4		F75	F2	E1	W6	W9	F14	DP	io6	Total
Atopic Dermatitis	**Male**	3	7	3	8	5	5	6	7	0	2	3	2	4	0		1	0	0	0	1	2	3	2	64
	Female	8	9	4	11	6	2	10	9	1	4	6	1	5	1		3	1	2	0	3	1	1	1	81
Allergic Rhinitis	**Male**	11	11	5	1	1	1	0	1	1	6	11	0	2	0		0	0	1	3	5	1	20	7	88
	female	14	13	7	2	2	1	1	2	1	9	13	1	1	1		1	0	1	4	2	1	19	4	100
		41	41	9	3	1	1	2	3	0	4	7	1	3	1		0	1	0	1	4	3	7	13	146
		55	34	12	4	4	3	3	3	1	2	4	1	2	1		1	0	1	3	6	1	13	16	170
		132	115	40	29	19	13	22	25	4	27	44	6	17	4		6	2	5	11	21	9	63	43	649

Table.5 showed that two hundred and thirty four patients attending to center of allergy and asthma diseases in Basrah city who had a chest and skin allergies with their age range from (1 day - >60) years Many investigators have shown temporal relationship between respiratory symptoms and exposure to allergen (Bousquet et al., 1990; Hammarlund et al., 1990). Sensitization to house dust mites was the commonest for both asthma and allergic rhinitis;

sensitization to the mould was significant with asthma while grass to allergic rhinitis (Wohrl et al., 2006).

Worldwide, the commonest cause of perennial allergic rhinitis is allergy to house dust mite species including "Dermatophytes, pteronysinnus, Dermatophytes, Farinae and Dermatopytes, Eurgluphus". Other major perennial- allergen including domestic pets (cats, dogs, rabbits and horses) (Isik et al., 2011). House Dust Mite and other allergens have been shown to be capable of causing may of elements of allergy (Abramowitz et al., 1980; Petersen and Skov, 2003). One study showed that the most common allergen was the house dust mite followed by grass then domestics pets (dogs and cats) (Wood et al., 1999). This study showed that the most common inhalant allergen was (mites). Followed by (alternaria), then (grass), and followed by other aeroallergens as show in table 6 ,and this agreed with above studies. Other study demonstrated that sensitization to single allergen presented in (52%) of cases while sensitization to more than single allergen presented (48%) of cases (Anderson, 1992).Exposure of sensitive patients with asthma to inhalant allergens has been shown to increase airway inflammation , airway hyper responsiveness, asthma symptoms , the need for medication and death due to asthma (Novembre et al., 1995). The important finding of this study was that dermatophytes was the common inhalant allergens that had an association with asthma.It has been over 60 years ago since scientists proposed the exposure to dust mite was a cause of asthma in Germany (Bernstein et al., 2008). Subsequently others (Bernstein et al., 2008) in the 1960s confirmed the association. dermatophytes, alternaria and grass found to be the dominant risk factor for allergy (Nolte and DuBuske, 1997)**.** Inhalation of these allergens in sensitized subjects can cause immediate and late bronchoconstriction and wheezing (Ewan and Coote, 1990; Crobach et al., 1998; Wohrl et al., 2006; Bernstein et al., 2008; Nolte and DuBuske, 1997; Williams et al., 1992; Tschopp et al., 1998; King et al., 2008; Goldberg and Confino-Cohen, 1997; Dreborg, 1989).

Table 6: The role of various allergens in different types of atopic diseases for both sexes and various age groups in central and peripheral part of Basrah

Group	**Sex**		**Case History**			**Habit.**		**Allergens**
	Male	**Female**	**Allergic Rhinitis**	**Bronchial Asthma**	**Atopic Dermatitis**	**Central**	**Peripheral**	
1 Day <2 Years	0	0	-	-	-	-	-	-
2- 10 Y	7		2	2	3	5	2	D1, F49, F75, F2, M2, FX77, DP
		11	3	3	5	4	7	Gx7, F95, G2, D1, D2
11- 20 Y	17		5	7	5	10	7	D1, D2, M3, F4, DP, GX7, W6, F49
		24	4	12	8	12	12	D1, D2, DP, G2, D201, GX7, M1, M3, F49, E1, M2, M6
21- 30 Y	29		7	14	8	16	13	D1, D2, G2, DP, D201, M2/ M6, D1/D2, FX77, F95, W9, W6, F14
		33	8	18	7	19	14	D1, D2, G2, DP, D201, W6, W9, M5, F4, FX77
31- 40 Y	23		8	6	9	13	10	M5, FX77, W6, DP, D2, F14, M5, D201
		26	6	9	11	17	9	M1, M3, D201, IX267, DP, GX7,

								W6, D1
41- 50 Y	16		3	5	8	9	7	D1, D2, D201, F49, W6, DP
		18	4	9	5	11	7	D201, W6, F49, DP, D1, D2, G2
51- 60 Y	9		3	5	1	6	3	D1, D2, DP, G2, GX7, W6, M5
		8	1	4	3	5	3	D1, D2, W6, GX7, DP, M5, FX77, M3
Above 60 Y	5			2	3	4	1	W6, DP, D1, D2, M5, M3
		8	1	3	4	5	3	D1, D2, G2, M3, D201, W6
Total	106	128						
P= 0.0431 Significant			P= 0.1321 Not Significant				P= 0.192 Not Significant	

Table 7: Abbreviation of allergens name

Symbol	**Abbreviation**
D1	D. pteronassinus
F49	Apple
F75	Egg Yolk
F2	Cow milk
M2	Cladosporium Herbarum
FX77	Seafood Mix IV
DP	Mite
GX7	G grass mix
F95	Peach
G2	Bermuda grass polien
D2	D. Farinae

M3	Aspergillus fumigatus
F4	Wheat flour
W6	Mugwart pollen
D201	Blomia tropicallis
M1	Penicillium notatum
E1	Cat epithelia
M6	Altemaria altemate
W9	Plantain pollen
F14	Soyabean
M5	Candida albicans
Io6	Cockroach
Gx7	6 Grass mix

References

1. Abramowitz PW, Perez MM, Johnson CE, McLean JA (1980). Effect of theophylline, terbutaline, and their combination on the immediate hypersensitivity skin-test reaction. J Allergy Clin Immunol. 66(2): 123-128.
2. AL-SAIMARY IHSAN E . ALLERGIC DISEASES AMONG BASRAH POPULATION DURING 2013 -2014 . PYREX JOURNAL OF MICROBIOLOGY AND BIOTECHNOLOGY RESEARCH .1(1):1-17, 2015.
3. Alsaimary ,Ihsan Edan and Falih Hmood Mezban . Estimation of serum inflammatory cytokines(IL-4, IL 10 and IL 17) and total IgE concentrations in patients with bronchial asthma by ELISA technique. Journal of Medical Research and Health Sciences. JMRHS 4 (1), 1151-1155 (2021).DOI: https://doi.org/10.15520/jmrhs.v4i1.305.
4. Alsaimary, Ihsan Edan and Falih Hmood Mezban. Molecular Assessment of Gene Expression for Interleukine-4 and Interleukin-17 among Patients with Human Bronchial Asthma by Conventional and Real Time q-PCR Techniques . International Journal of Science and Research (IJSR). DOI: https://10.21275/SR21119160619. Volume 10 Issue 2, PP:165-169February 2021.
5. AlSaimary, Ihsan Edan and Falih Hmood Mezban Diagnostic Accuracy of Immunological Markers for Detection of Allergens by Poly Check Techniques among Patients with Bronchial Asthma in Basrah, Southren of Iraq. Journal of Biotechnology & Bioinformatics Research. SRC/JBBR-125. Volume 3(1): 1-16. (2021).
6. AlSaimary, Ihsan Edan and Falih Hmood Mezban . Flow cytometry-based profiling of immune cells among patients with bronchial asthma in Basrah, Iraq. Journal of Medical Research and Health Sciences. JMRHS 4 (3), 1111−1118 (2021) .DOI:

https://doi.org/10.15520/

7. AlSaimary, Ihsan Edan and Falih Hmood Mezban . Skin-prick test reactions to various allergens in asthmatic patients . Journal of Medical Research and Health Sciences. JMRHS 4 (3), 1119−1124 (2021) DOI: https://doi.org/10.15520/
8. AlSaimary, Ihsan Edan and Falih Hmood Mezban. Clinical findings of patients with human bronchial asthma in Basrah, Iraq. Applied medical research.8 (2).:1-4. 2021. ISSN: 2149-2018 DOI: 10.5455/amr.20211040.
9. AlSaimary, Ihsan Edan and Falih Hmood Mezban Spirometric criteria for airway obstruction: use percentage of FEV1 ratio as a Pulmonary function test for asthmatic patients in Basrah , Iraq. Journal of Medical Research and Health Sciences JMRHS 4 (10), 1100□1103 (2021). (https://creativecommons.org/licenses/by-nc-nd/4.0/).
10. Anderson JA (1992). Allergic reactions to drugs and biological agents. JAMA. 268(20): 2844-2857.
11. Brockmann, et, .2014. Pablo E Brockmann, Pablo Bertrand, Jose A Castro-Rodriguez Sleep medicine reviews 18 (5), 393-397, 2014.
12. Bernstein IL, Li JT, Bernstein DI, Hamilton R, Spector SL, Tan R, Sicherer S, Golden DB, Khan DA, Nicklas RA, Portnoy JM, BlessingMoore J, Cox L, Lang DM, Oppenheimer J, Randolph CC, Schuller DE, Tilles SA, Wallace DV, Levetin E, Weber R (2008). Allergy diagnostic testing: an updated practice parameter. Ann Allergy Asthma Immunol. 100 (3 Suppl 3): S1-S148.
13. Bousquet J, Chanez P, Chanal I, Michel FB (1990). Comparison between RAST and Pharmacia CAP system: a new automated specific IgE assay. J. Allergy Clin. Immunol. 85 (6): 1039-1043.
14. Bousquet J, Lebel B, Dhivert H, Bataille Y, Martinot B, Michel FB (1987). Nasal challenge with pollen grains, skin-prick tests and specific IgE in patients with grass pollen allergy. Clin Allergy. 17(6): 529-536.
15. Czarnowicki,et al.,2015. Tali Czarnowicki, Juana Gonzalez, Avner Shemer, Dana Malajian, Hui Xu, Xiuzhong Zheng, Saakshi Khattri, Patricia Gilleaudeau, Mary Sullivan-Whalen, Mayte Suárez-Fariñas, James G Krueger, Emma Guttman-YasskyJournal of Allergy and Clinical Immunology 136 (1), 104-115. e7, 2015.
16. Crobach MJ, Hermans J, Kaptein AA, Ridderikhoff J, Petri H, Mulder JD(1998). The diagnosis of allergic rhinitis: how to combine the medical history with the results of radio allergosorbent tests and skin prick tests. Scand J Prim Health Care. 16 (1): 30-36.
17. Dreborg S (1989). The skin prick test in the diagnosis of atopic allergy. J. Am. Acad. Dermatol. 21 (4 Pt 2): 820-821.
18. Ewan PW, Coote D (1990). Evaluation of a capsulated hydrophilic carrier polymer (the ImmunoCAP) for measurement of specific IgE antibodies. Allergy. 45(1): 22-29.
19. Falih hmood mezban, Ihsan edan alsaimary. 2016. Significance of Skin test reactivity to aeroallergens in patients with chest and skin allergies in Basrah through 2014 and 2015. Basic Research Journal of Microbiology. Vol. 3(6)
20. Goldberg A, Confino-Cohen R (1997).Timing of venom skin tests and IgE determinations after insect sting anaphylaxis. J. Allergy Clin. Immunol. 100(2): 182-184.
21. Hammarlund A, Olsson P, Pipkorn U (1990). Blood flow in histamineand allergen-induced weal and flare responses, effects of an H1 antagonist, alpha-adrenoceptor agonist and a topical glucocorticoid, Allergy. 45(1): 64-70.
22. Hammarlund A, Pipkorn U, Enerback L (1990). Mast cells, tissue histamine and eosinophils in early- and late-phase skin reactions: effects of a single dose of prednisolone. Int Arch Allergy Appl Immunol. 93(2–3): 171-177.
23. Isik SR, Celikel S, Karakaya G, Ulug B, Kalyoncu AF (2011). The effects of antidepressants on the results of skin prick tests used in the diagnosis of allergic diseases. Int Arch Allergy Immunol. 154(1): 63-68.
24. Jonathan Jackson, Mai Stafford The British Journal of Criminology 49 (6), 832-847, 2009.
25. King MJ, Tamulis T, Lockey RF (2008). Prick puncture skin tests and serum specific IgE as predictors of nasal challenge response to dermatophagoides pteronyssinus in older adults. Ann Allergy Asthma Immunol. 101(1): 12-17.
26. Kauffman et al.,2002 Gerard H Koppelman, O Colin Stine, Jianfeng Xu, Timothy D Howard, Siqun L Zheng, Henk F Kauffman, Eugene R Bleecker, Deborah A Meyers, Dirkje S Postma Journal of Allergy and Clinical Immunology 109 (3), 498-506, 2002.
27. Kilpeläinen, M., E. O. Terho, H. Helenius, and M. Koskenvuo. 2000. Farm envi- ronment in childhood prevents the development of allergies. Clinical and Experimental Allergy 30 (2): 201-208.

28. Larché, Cezmi A Akdis, Rudolf Valenta Nature Reviews Immunology 6 (10), 761-771, 2006.

29. Maddox Lee, David A Schwartz Annual review of medicine 53 (1), 477-498, 2002.

30. Mezban , Falih Hmood and Ihsan Edan Alsaimary. Estimation of risk factors affecting patients associated with bronchial asthma in Basrah, southern Iraq: Case-control observational study. Journal of Medical Research and Health Sciences. DOI: https://doi.org/10.15520/jmrhs.v4i1.304 JMRHS 4 (1), 1146-1150 (2021).

31. Mingomataj, EC Xhixha,F, E Gjata, E Hyso, E Qirko Journal of Investigational Allergology and Clinical Immunology 18 (3), 190, 2008.

32. Marin A, Eseverri JL, Botey J. From atopic dermatitis to asthma. Allergol Immunopathology. 1998; 26:114–9.

33. November E, Bernardini R, Bertini G, Massai G, Vierucci A (1995). Skin-prick-test-induced anaphylaxis. Allergy. 50(6): 511-513.

34. Nolte H, DuBuske LM (1997). Performance characteristics of a new automated enzyme immunoassay for the measurement of allergenspecific IgE. Summary of the probability outcomes comparing results of allergen skin testing to results obtained with the HYTEC system and CAP system. Ann Allergy Asthma Immunol. 79(1): 27-34.

35. Philippe A Eigenmann ean-Christoph Caubet, Laurent Kaiser, Barbara Lemaître, Benoît Fellay, Alain Gervaix, Journal of Allergy and Clinical Immunology 127 (1), 218-222, 2011.

36. Petersen LJ, Skov PS (2003). Effect of terbutaline and bambuterol on immediate-type allergic skin responses and mediator release in human skin. Inflamm Res. 52(9): 372-377.

37. Rehana Majeed, UD Rajar, Naheed Shaikh, Farrukh Majeed, Aijaz A Arain J Coll Physicians Surg Pak 18 (5), 299-302, 2008.

38. Tschopp JM, Sistek D, Schindler C, Leuenberger P, Perruchoud AP, Wuthrich B, Brutsche M, Zellweger JP, Karrer W, Brandli O (1998). Current allergic asthma and rhinitis: diagnostic efficiency of three commonly used atopic markers (IgE, skin prick tests, and Phadiatop). Published by Basic Research Journal of Microbiology Results from 8329 randomized adults from the SAPALDIA Study. Swiss Study on Air Pollution and Lung Diseases in Adults. Allergy. 53 (6): 608-613.

39. Tschopp JM, Sistek D, Schindler C, Leuenberger P, Perruchoud AP, Wuthrich B, Brutsche M, Zellweger JP, Karrer W, Brandli O (1998). Current allergic asthma and rhinitis: diagnostic efficiency of three commonly used atopic markers (IgE, skin prick tests, and Phadiatop). Results from 8329 randomized adults from the SAPALDIA Study. Swiss Study on Air Pollution and Lung Diseases in Adults. Allergy. 53 (6): 608-613.

40. Von Mutius, E.; Braun-Fahrlander, C.; Schierl, R.; Riedler, J.; Ehlermann, S. and Maisch, S. (2000). Exposure to endotoxin or other bacterial components might protect against the development of atopy. Clin Exp Allergy.;30(9):1230-1240.

41. Wohrl S, Vigl K, Zehetmayer S, Hiller R, Jarisch R, Prinz M, Stingl G, Kopp T (2006). The performance of a component-based allergenmicroarray in clinical practice. Allergy. 61(5): 633-639.

42. Wood RA, Phipatanakul W, Hamilton RG, Eggleston PA (1999). Acomparison of skin prick tests, intradermal skin tests, and RASTs in the diagnosis of cat allergy. J Allergy Clin Immunol. 103(5 Pt 1): 773-779.

43. Yaghmaie, Caroline W Koudelka, Eric L SimpsonJournal of Allergy and Clinical Immunology 131 (2), 428-433, 2013.

44. Zhang, Jonathan I Silverberg Journal of the American Academy of Dermatology 72 (4), 606-616. e4, 2015.