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Induced Immunity of Response to Some Allergens Towards Response of Other Skin Test Allergens and Its Correlation with Immediate Hypersensitivity Reactions

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Abstract: Allergens are innocuous environmental antigens that cause IgE mediated hypersensitivity reactions. These antigens can be divided into several groups according to their nature like plant allergens, grasses, fungal allergens, pollen grains and house dust mite. Skin response to such allergens is associated with each other either by positive relation (positive correlation) or negative (inverse) relation. No previous papers found to discuss such correlations. In order to investigate these correlations, skin prick test of standard allergens solutions was carried out in 500 patients suffering allergic reactions of the age 12-60 years of both sexes. The results showed that there is a high significance of positive and negative correlations in skin response to allergens in the same group and with allergens of different groups suggesting that there is an induction or suppression of immune response. In conclusion the similarity or dissimilarity in the primary structure of some allergens in addition to gene-environment interaction may reflect positive/negative correlations between certain allergens that can influence the related allergic reactions.

Key words: Correlations, allergens, allergic reactions, cross reactions.

1. Introduction

Allergens are innocuous environmental antigens that cause IgE mediated hypersensitivity reactions. A normal allergen is composed of protein or glycoprotein [1]. According to route of entry to human body, the allergens can be classified into: ingested allergens like certain types of food and drugs, inhaled allergens such as dust, pollen and fungus spores, injected allergens like insects' toxins and contact allergens that cause delayed hypersensitivity reactions that enter through the skin just like some metals [2]. Allergens can be also subdivided into major allergens and minor allergens that have molecular weight of about (10000 Daltons).

There is no clear difference between allergens and antigens, allergens may be originated from plants, animals, fungi and materials that are protein substances complete or incomplete haptens associated with serum proteins or tissues to become a complete allergens having two or more antigenic determinants necessary to stimulate immune response [3]. Currently, little is known about why these proteins are associated with the production of specific IgE antibodies in susceptible individuals and the mechanism involved in causing sensitization. In this context, a committee organized by the World Health Organization (WHO), Food and Agriculture Organization (FAO) and the European Food Safety Authority (EFSA) proposed that a novel protein was likely to be an allergen if its amino acid sequences contain contiguous amino acids that are identical to known allergens [4]. Furthermore, there is new rising data showing that some allergens have identical primary structures which can cause the cross reaction between them and responsible for the false positive skin test results especially for allergens

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from the same origin [5]. The current study aims to clarify the relationships between immune response to common allergens used in this study with each other and with related allergic diseases resulted from exposure to them.

2. Materials and Methods

2.1 Study Population

The current study involved a random sample of five hundreds (500) allergic persons who registered in the Division of Allergy at AL-Jomhury Teaching Hospital in Mosul city during the period (Jan. 2012-Aug. 2013) aged between (12-60 years old) and from both sexes.

2.2 Skin Prick Test

All persons included in the current study were subjected to skin prick test by using standard allergen solutions manufactured by [6] and comprises (*Dermatophagoides ptreonyssinus* D.P and *Dermatophagoides frainea* D.F, Mite, Pollen, Grass, Bermuda, Mugwart, Plantain, Chenopodium, in addition to four mold allergens included: M1 (*Penicillium* spp. *Aspergillus* spp. *Cladosporium* spp. *Alternaria* spp.), M2 (*Botrytis* spp. *Mucor* spp. *Rhizopus* spp. and *Stemphylium* spp.), M3 *(Fusarium* spp. *Chaetomium* spp. *Neurospora* spp. and *Pullularia* spp.) and M4 (*Helmenthosporium* spp. *Epicuccum* spp. and *Trichothecium* spp.). Also three tree allergens involved: T1 (*Fugus sylartica*, *Costanea vulgaris* and *Quercus robur*), T2 (Cupressus sempervirens, *Morus alba*, *Olea eurpae* and *Ligustrum vulgare*) and T3 (*Alnusqu tinosa, Betula alba*, *Corylus avellama* and *Carpinus betulus*). The skin prick test was performed as described by J. Ring [7].

2.3 Statistical Analysis

Bivariate correlation (coefficient of Person) was used to analyze the results and elucidation of the different relationships between responses to all allergens used in the study and between the related allergic symptoms.

3. Results and Discussion

As shown in Tables 1 to 3, there is a positive correlation between the allergens D.F, D.P, and mite with each other and these allergens were also positively and negatively correlated with molds allergens (M1, M2, M3 and M4), Grass, Bermuda, Plantain, tree allergens (T1, T2 and T3), Pollens, Mugwart and Chenopodium, which also have a different correlations between each other. The negative correlations have been seen between D.P and M3, M4, and between Mite with M2 and M4. However, the mold allergens had a positive correlation between each other. This means that the response to house dust allergen D.F could stimulate the innate response to D.F, Mite and the three molds (M1, M2 and M4) and inhibit response only to M3 allergen, while response to D.P might inhibit response to M2 and M4 and stimulate the response to other allergens. In the same way, the responses to Mite inhibit M2 and M4 and stimulate other allergens as shown in Table 1. In addition, the response to one the four molds may induce the response to the others.

Also, Table 2 shows that D.F, D.P and Mite allergens were negatively correlated with Grass, Bermuda and Plantain allergens. There is a positive correlation between Grass with both Bermuda and Plantain and negative correlation between Bermuda with Plantain. This means that the person who allergic to one of the herbal allergens (Grass, Bermuda and Plantain) might be not allergic to D.F, D.P and Mite and vice versa.

Considering the correlation between Tree allergens (T1, T2, T3), Pollens, Mugwart and Chenopodium with D.F, D.P and Mite, Table 3. The Tree allergens were positively correlated with each other, however, T1 and T2 were negatively correlated with all allergens in Table 3, while, T3 had a positive correlation only with Chenopodium and negative correlation with other allergens. On the other hand, Pollen has negative correlation with Mugwart and Chenopodium and positive with D.F, D.P and Mite, while the correlation was positive between Mugwart and Chenopodium and

Table 1 Correlation between D.F, D.P and Mite with each other and with molds.

Correlation	D.F	D.P	Mite	M1	M2	M3	M4
D.F	+	+**	+**	+	+	-	+
D.P	+**	+	+	+**	+	-	-
Mite	+**	+**	+	+	-	+	-
M1	+	+**	+	+	+**	+*	+
M2	+	+	-	+**	+	+**	+
M3	-	-	+	+*	+**	+	+**
M4	+	-	-	+	+	+**	+

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

Table 2 Correlation between herbal allergens with D.F, D.P and Mite allergens.

Correlation	Grass	Bermuda	Plantain	D.F	D.P	Mite
Grass	+	+**	+	-**	-**	-**
Bermuda	+**	+	-	-**	-**	-**
Plantain	+	-	+	-*	-*	-**

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

Table 3 Correlations between Tree allergens with each other and with pants and pollens and D.F, D.P, Mite.

Correlation	T1	T2	T3	Pollen	Mugwart	Chenopodium	D.F	D.P	Mite
T1	+	+**	+*	-	-	-	-**	-**	-**
T2	+**	+	+**	-**	-	+	-**	-**	-**
T3	+*	+**	+	-	-	+	-**	-**	-**
Pollen	-	-**	-	+	-	-	+	+	+**
Mugwart	-	-	-	-	+	+**	-**	-**	-*
Chenopodium	-	+	+	-	+**	+	-**	-*	-

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

negative between Mugwart and D.F, D.P and Mite, the correlation was also negative between Chenopodium with D.F, D.P and Mite.

In the summary: patients who allergic to D.F, D.P and Mite, may not response to tree and plant allergens and response to Pollens.

There are different correlations between the mold allergens and others, as it is shown in Table 4 and Table 5. The molds have negative correlations with Grass, Bermuda and Plantain as shown in Table 4. Furthermore, molds also were negatively correlated with T1, T2, T3, Mugwart and Chenopodium while pollen was correlated positively with M1, M2, M3 and negatively with M4 (Table 5). This means that the response to the molds could inhibit the response to Plant and Tree allergens, however, patients how allergic to Pollen may respond positively to all molds except M4.

Table 6 shows that there are different correlations between plant allergens and Tree allergens with Herbal allergens, as, Grass have a positive correlation with T1, T2, T3, Mugwart and Chenopodium. However, the correlation was negative between Grass and Pollen only. In addition, the correlation was negative between Bermuda with all allergens except Mugwart and Chenopodium where the correlation was positive. In the same case, Plantain allergen was positively correlated with all allergens except Pollen and Mugwart. This could be explained by the fact that persons who allergic to herbal allergens may develop allergic response to plant and tree allergens and did not respond to Pollens.

Table 4 Correlations between Molds and Plant allergens.

Correlations	M1	M2	M3	M4
Grass	-	-**	-**	-
Bermuda	-**	-**	-**	-
Plantain	-*	-	-**	-**

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

Table 5 Correlations between Molds with Tree, Pollen, Mugwart and Chenopodium allergens.

Correlation	M1	M2	M3	M4
T1	-*	-	-	-
T2	-**	-**	-*	-**
T3	-*	-	-	-
Pollen	+	+;	+	-
Mugwart	-*	-*	-	-**
Chenopodium	-**	-**	-	-**

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

Table 6 The correlation between Tree and Plant and Pollen allergens with Herbal allergens.

Correlation	T1	T2	T3	Pollen	Mugwart	Chenopodium
Grass	+	+	+	-**	+**	+
Bermuda	-*	-	-	-*	+**	+**
Plant	+**	+**	+	-**	-*	+*

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

Generally the correlations between certain allergens may reflect the induction and inhibition of immune response towards these allergens. In this context, the positive correlations (Tables 1-6) could reflect the cross-reaction to certain allergen with IgE antibody specific to another one having close or similar primary (amino acid sequence) structure. Because of the similarity in the structure between D.F and D.P allergens, IgE antibody specific for D.F allergen might cross-reacted with D.P leading to false positive wheal and flare reaction on the skin [8]. However, the genetic predisposition of some allergic patients what decide to be responsive to certain allergens and not responsive to others [9].

On the other hand, the negative correlations (Tables 1-6) usually found between allergens related to groups that dissimilar in the primary structure (from different sources) as the correlation between D.F and Grass allergens. Generally, this due to the blockage of all IgE receptors on the surfaces of mast cells and basophils by IgE antibodies specific to certain allergen that entered the body at first. Thus, when new allergen enters the body, its specific IgE antibodies will not find free receptors to bind and produces symptoms. However, this mechanism was first suggested by Yazdanbakhsh et al. [10] and M. Capron [11] to explain how parasite infections prevent allergies, the IgE specific to certain parasite cover all IgE receptors and prevents allergen specific IgE from binding to mast cells and cause allergy. Furthermore, the genetic structure of patients also has important effect in response to specific allergen as noticed by D.Y. Wang [12] who concluded that persons from rural environment have a genetic tolerance to allergen existing from early life.

The study also considered the correlation between skin test allergens and related allergic diseases. However, the results suggests, as Table 7 shows, that

Table 7 The correlations between skin test allergens and related allergic diseases.

Correlations	Allergic Bronchitis	Allergic Rhinitis	Atopic Dermatitis
D.F	+	-	-
D.P	+**	-	-
Mite	+	-	+
M1	+*	-	-
M2	+*	-	+
M3	+	-	+
M4	+	+	-
Grass	+	+**	-
Bermuda	-	+**	-*
Plantain	+	+	-
T1	-	-	+
T2	-	+*	-
T3	-	+	+
Pollen	-*	-	+
Mugwart	-	+*	-
Chenopodium	-	+	+

**. Correlation is significant at the (0.01).level +. Means positive correlation

*. Correlation is significant at the (0.05).level -. Means negative correlation

allergic bronchitis has positive correlation with D.F, D.P, Mite, M1, M2, M3, M4, Grass and Plantain, allergens and negatively correlated with Bermuda, T1, T2, T3, Pollen, Mugwart and Chenopodium allergens, while the correlation was negative between allergic rhinitis and D.F, D.P, Mite, M1, M2, M3, T1 and Pollen allergens, and positive with Grass, Bermuda, Plantain, T2, T3, Mugwart and Chenopodium allergens.

In addition, atopic dermatitis had a negative correlation with D.F, D.P, M1, M4, Grass, Bermuda, Plantain, T2, and Mugwart allergens, and a positive correlation with Mite, M2, M3, T1, T3, Pollen and Chenopodium allergens.

This means that allergic bronchitis may result from positively correlated allergens (especially when the correlation is significant), and not caused by negatively correlated allergens (especially when the correlation is significant). Therefore, this explanation could be suitable for other allergic diseases in the Table 7.

The nature of allergen and its route of exposure could be a good reason in that. It is well known that airborne allergens (such as D.F, D.P and Pollen) attach to the airways mucous membrane and cause asthma, allergic rhinitis and allergic bronchitis, while, Grass and Bermuda are the common cause of atopic dermatitis [13, 14]. Moreover, the climate condition may have an important role, as we previously mentioned, the rural environment give immune tolerance to naturally exiting rural allergens which, in the same way, cause symptoms to patients in urban areas [15]. Furthermore, gene-environment interactions, may determine the certain type of allergic disease that patients may develop [16].

4. Conclusions

There is a correlation between immune response to common allergen and related allergic diseases, this correlation could suggest reflecting the induction/inhibition of patients' response to certain allergen and the resulted allergic symptoms. A further study needed on the molecular level to confirm these results.

References

[1] Chmara, P. R., Wronka, I., and Muc, M. 2008. "Prevalence and correlates of allergic diseases among children." *Journal of Physiology and Pharmacology* 59

(6): 546-556.

[2] Pawankar, R., Canonica, G. W., Holgate, S. T., and Lockey, R. F. 2011. *WAO White Book on Allergy. Executive summary*. World Federation of Allergy, Asthma and Clinical Immunology Societies, USA.

[3] Okada, H., Kuhn, C., Feillet, H., and Bach, J. F. 2010. "The hygiene hypothesis for autoimmune and allergic diseases: An update." *Clinical and Experimental Immunology* 160: 1-9.

[4] Shein, C. H., Ivanciuc, O., Midoro-Horiuti, T., Goldbum, R. M., and Braun, W. 2010. "An allergen portrait gallery: Responenative structures and an overview of IgE binding surfaces." *Bioinformatics and Biology Insights* 4: 113-125.

[5] Aalberse, R. S., Akkerdaas, J. H., and Ree, V. R. 2001. "Cross-reactivity of IgE antibodies to allergens." *Allergy* 56: 478-490.

[6] Stallergenes, 2009. *Allergen vaccines worldwide, France*。.

[7] Ring, J. 2005. *Allergy in Practice*. Berlin. Springer.

[8] Pfiffner, P., Truffer, R., Matsson, P., Sosi, G., Mari, A., and Stadler, B. M. 2010. "Allergen cross reaction: A problem greater than ever thought?" *Allergy* 65: 1536-1544.

[9] Madore, A. M., and Laprise, C., 2002. "Immunological and genetic aspects of asthma and allergy." *Journal of Asthma and Allergy* 3: 107-121.

[10] Yazdanbakhsh, M., Kremsner, P. G., and Ree, R. V. 2002. "Allergy, parasite and the hygiene hypothesis." *Science* 296: 490-494.

[11] Capron, M. 2011. "Effect of parasite infection on allergic diseases." *Allergy* 66 (suppl. 95): 16-18.

[12] Wang, D. Y. 2005. "Risk factor of allergic rhinitis: genetic or environmental?" *Therapeutics and Clinical Risk Management* 1 (2): 115-123.

[13] Cashe, P., Newhouse, B. S., and Levetin, E. 2004. "Correlation of environmental factors with asthma and rhinitis symptoms in Tulsa, OK." *Ann*. *Allergy Asthma Immunol*. 92: 356-377.

[14] Peden, D., and Charles, R. 2010. "Environmental and occupational allergies." *J*. *Allergy Clin*. *Immunol*. 125: 150-60.

[15] Jenerowicz, D., Sliny, W., Pazdrowska, A. D., Polanska, A., Mankowska, A. O., and Hrab, K. O. 2012. "Environmental factors and allergic diseases." *Annals of Agricultural and Environmental Medicine* 19 (3): 475-481.

[16] Renz, H., Conard, M., Brand, S., Teich, H., Pfefferle, P. I. 2012. Allergic diseases, gene-environment interactions, *Allergy* 66 (suppl. 95): 10-12.