PEDIATRICS

Shmulich V.K., Uryvayva M.K., Lupaltsova O.S., Staruseva V.V., Rybka O.S., Shmulich O.V., Kryvenko L.S.

COMPARATIVE ANALYSIS OF THE ROLE OF DOMESTIC ALLERGENS IN ATOPIC DERMATITIS ETIOLOGY IN CHILDREN

Kharkiv National Medical University, Ukraine

Abstract. *Four hundred and thirty-eight children aged 4 to 18 suffering from atopic dermatitis in the sustained remission phase in the course of the disease were studied using the skin prick testing technique. Prevalence of children of pre-school and primary school age with the atopic dermatitis was established. Skin acariasis caused by Dermatophagoides farinae mites prevails which can be used to optimize specific immunotherapy of atopic of dermatitis in children. Children of the senior school age were the least sensitive to A. Daphnia magna. Suitability of the start elimination therapy was proved. The detected age and sex etiological features of (atopic dermatitis) AD in the large population of children related mostly to the prevailing role of domestic triggers suggest the urgent necessity to eliminate the allergens in the residential premises where children suffering from allergic diseases live, as well as in the places where healthy children live, since the long contact with the indoor allergens is potentially hazardous regarding sensitization formation.*

Keywords*: atopic dermatitis, domestic allergens, children.*

One of the leading causes of atopic dermatitis (AD) in children is sensitizing to different domestic allergens. The findings of multiple studies prove that contacting with different allergens contained in the house dust is the most important factor inducing the onset of bronchial asthma. The role of domestic allergens in development of allergic rhinitis, as well as atopic dermatitis and allergic urticaria was also very important [1-5].

Most authors [6-8] note that allergenic aggressiveness of house dust depends primarily on the number and kinds of mites inhabiting it which belong, generally, to *Dermatophagoides* genus of *Pyroglyphidae* family, among them *Allergenum e pulvere domesticum e Dermatophagoides pteronyssinus*, *Allergenum e pulvere domesticum e Dermatophagoides farinae*, *Allergenum e pulvere domesticum ex Acarus siro*. Besides, domestic allergens include *Allergenum e pulvere bibliothecae*, *Allergenum e pluma pulvini*, and *Allergenum e Daphnia magna*.

Aims and purposes. The aim of study was the specification of casually significant allergen depending on sex and age. We set the problem to make a

comparative assessment of the significance of home aeroallergens in etiologic spectrum of atopic dermatitis in children according to age and gender by prick-test in the period of stable remission of the disease.

Materials and Methods. We observed 438 children with atopic dermatitis aged 4 to 18 years. Depending on the age the patients were divided into three groups: Group 1 at the age of 4-8 year old, Group 2 - 9-12 year old, 3 group - 13-18 years old, allergological testing is done by skin prick test.

The objective of the study was comparative assessment of the significance of home aeroallergens in etiology of atopic dermatitis in children. We observed 438 children aged 4 to 18 with atopic dermatitis. The work is implemented in regional children's allergy center based in Regional children's clinical hospital #1 in Kharkov.

Skin testing with allergens has been a valuable method of allergy testing. The objective of tests is confirming the role of allergens in the development of the disease, which suggestive of hypersensitivity according to anamnesis. This is a highly sensitive method enabling to determine specific sensitization by percutaneous allergen injecting and evaluation of the magnitude and nature of the urtica or inflammatory reaction. Testing can be performed using scratch test, injection test, prick test, and the intradermal test techniques. We have performed allergy prick testing used to discover I type reactions.

The indications for skin testing with allergens were clinical anamnesis, the data of clinical, and laboratory examinations.

Standard serial allergens containing 10,000 PNU in 1 ml made of pollen, house dust, wool, food etc. were used for skin testing (producer LRS Immunolog, 21036, Vinnica, P.O.B. 4283, Zbyzhka street, 5). The principle of skin testing is based on the fact that the allergen applied to the skin interacts with Langerhans cells and macrophages. In case of sensitization, such interaction results in releasing of allergic mediators and in the development of a local allergic reaction.

Assessment of skin test results. The skin test results are assessed in 15 to 20 minutes (immediate reaction). The reaction is assessed according to the pattern in Table # 1 below. Skin reaction to histamine should be positive, in case of negative reaction allergen test should be made. Skin reaction to test control fluid should be negative, in case of positive reaction the allergen tests should be considered [9].

Table 1

Skin test assessment pattern

Allergic reaction types	**Prick testing**	
	Papule size, mm	Legend
Negative	0	-
Slightly positive	1-2	+
Positive	3-7	++
Strong positive	8-12	+++
Hyperergic	13 and over	++++

We analyzed the test results by the degree of manifestation of skin reaction to the specific allergen to determine the most probable allergens in case of onset or exacerbation of atopic dermatitis in children. The range of allergic reactions from (++) to (+ + + +) was considered causally significant in the etiologic spectrum of the disease. Results of testing are processed by a method of the mathematical analysis, raised in nomograms according to which, considering the nosological entity of disease, sex and age of patient, it's defined causally significant allergen.

According to Table 2, the number of children suffering from AD, prevails significantly in pre-school and early school age, with advancing age the number of children with AD decreases which is statistically significant (P<0.05).

Table 2

The results of the observations. Allocation of patients depending on sex and age

Parameter	Age (years)						Total
	4–8		9–12		13–18		
	B	G	B	G	B	G	
abs.	n=111	n=139	n=49	n=41	n=73	n=25	438
p%±$s_{p\%}$	25.3±2.1	31.7±2.2	11.2±1.5	9.4±1.39	16.7±1.7	5.7±1.1	
P	P >0.05		P >0.05		P >0.05		
abs.	251		90		98		
p%±$s_{p\%}$	57.3±2.3		20.5±1.9		22.4±1.9		
P	$P_{(4-8)/(9-12)}$ >0.05; $P_{(4-8)/(13-18)}$ <0.05; $p_{(9-12)/(13-18)}$ >0.05						

The findings of the study suggest that domestic allergens play an important role in the etiological spectrum of AD in children. *Dermatophagoides farina* which causes hyperergic skin reactions in boys of all age groups and in pubertal girls should be considered causally significant for occurrence of atopic dermatitis in children among the domestic triggers, children aged 9-12 and 13-18 have minimal reaction to other domestic allergens, however, hyperergic skin reactions occur in children aged 4 to 8 years, especially boys, for all domestic allergens.

Such an immunopathologic situation facilitates development of a preparation for the specific immunotherapy (ASIT) for children suffering from AD aged 9 to 12 and 13 to 18. Development of an effective monovalent vaccine for children aged 4 to 8 would be difficult due to polyvalent property of the domestic allergy.

Hyperergic reactions to daphnia allergens occurred primarily in boys aged 4 to 8 years, less frequently in girls aged 4 to 8 years. Daphnia allergens are not causally significant for children of the elder age groups (Table 3 to 6).

The detected age and sex etiological features of AD in the large population of children related mostly to the prevailing role of domestic triggers suggest the urgent necessity to eliminate the allergens in the residential premises where children suffering from allergic diseases live, as well as in the places where healthy children live, since the long contact with the indoor allergens is potentially hazardous regarding sensitization formation.

Table 3

Allergy reaction grade during testing of children suffering from AD with domestic allergens (absolute measures)

Allergens	Atopic dermatitis																			
	Age (years)																			
	4-8								9-12								13-18			
	boys (n-111)				girls (n-139)				boys (n-49)				girls (n-41)				boys (n-73)				girls (n-25)			
Allergy grade	1+	2+	3+	4+	1+	2+	3+	4+	1+	2+	3+	4+	1+	2+	3+	4+	1+	2+	3+	4+	1+	2+	3+	4+
	1				2				3				4				5				6			
A.D. pteroniss imus	7	17	7	2	21	17	3	0	5	5	1	0	6	2	0	0	9	6	2	0	2	0	0	0
A.D. farina	17	14	10	22	39	18	2	0	18	3	19	0	8	5	1	0	20	13	22	16	11	0	13	0
A.P. bibliothe cae	8	14	10	1	21	15	4	0	5	5	0	0	4	3	1	0	7	6	5	0	2	0	0	0
A.D. Acarus siro	6	14	8	5	22	14	3	0	6	4	1	0	3	3	2	0	6	6	6	1	2	0	0	0
A.P. pulvini	4	18	7	4	24	11	4	0	8	3	0	0	6	1	1	0	9	5	2	0	2	1	0	0
A. Daphnia magna	9	11	8	6	24	14	2	0	5	5	0	0	7	1	0	0	8	7	1	0	2	0	0	0

In this regard the use of available highly sensitive specific method of detection of allergic pathology, reduction of invasive method of research in children and simultaneous search for techniques prior in social and economic aspects for the purpose of well-timed correction and prevention of these conditions and having good prospects.

Table 4. **Allergy reaction rate during testing of children suffering from AD with domestic allergens aged 4 to 8 years,** ($p\%\pm s_{p\%}$)**.**

Sex	**Boys (n=111)**				**Girls (n=139)**			
Allergy grade	1+	2+	3+	4+	1+	2+	3+	4+
Allergens	($p\%\pm s_{p\%}$)				($p\%\pm s_{p\%}$)			
A.D. pteronissimus	6.3±2.3	15.3±3.4	6.3±2.3	1.8±1.2	15.1±3.0	12.2±2.7	2.2±1.2	0
A.D. farina	15.3±3.4	12.6±3.1	9±2.7	19.8±3.7	28.1±3.8	12.9±2.8	1,4±0.9	0
A.P. bibliothecae	7.2±2.4	12.6±3.1	9±2.7	0.9±0.8	15.1±3.0	10.8±2.6	2.9±1.4	0
A.D. Acarus siro	5.4±2.1	12.6±3.1	7.2±2.5	4.5±1.9	15.8±3.1	10.1±2.5	2.2±1.2	0
A.P. pulvini	3.6±1.7	16.2±3.5	6.3±2.3	3.6±1.7	17.3±3,2	7.9±2.3	2.9±1.4	0
A. Daphnia magna	8.1±2.5	9.9±2.8	7.2±2.5	5.4±2.1	17.3±3.2	10.1±2.5	1.4±0.9	0

Table 5. **Allergy reaction rate during testing of children suffering from AD with domestic allergens aged 9 to 12 years,** ($p\%\pm s_{p\%}$)**.**

Sex	**Boys (n=49)**				**Girls (n=41)**			
Allergy grade	1+	2+	3+	4+	1+	2+	3+	4+
Allergens	($p\%\pm s_{p\%}$)				($p\%\pm s_{p\%}$)			
A.D. pteronissimus	10.2±4.3	10.2±4.3	2±2	0	14.6±5.5	4.9±3.3	0	0
A.D. farina	36.7±6.8	6.1±3.4	38.8±6.9	0	19.5±8.2	12.2±5.1	2.4±2.4	0
A.P. bibliothecae	10.2±4.3	10.2±4.3	0	0	9.8±4.6	7.3±4.6	2.4±2.4	0
A.D. Acarus siro	12.2±4.6	8.2±3.9	2±2.0	0	7.3±4.1	7.3±4.1	4.9±3.4	2.4±2.4
A.P. pulvini	16.3±5.2	6.1±3.4	0	0	14.6±5.5	2.4±2.4	2.4±2.4	0
A. Daphnia magna	10.2±4.3	10.2±4.3	0	0	17.1±5.8	2.4±2.4	0	0

Table 6. **Allergy reaction rate during testing of children suffering from AD with domestic allergens aged 13 to 18 years,** ($p\%\pm s_{p\%}$)**.**

Sex	**Boys (n=73)**				**Girls (n=25)**			
Allergy grade	1+	2+	3+	4+	1+	2+	3+	4+
Allergens	($p\%\pm s_{p\%}$)				($p\%\pm s_{p\%}$)			
A.D. pteronissimus	12.3±3.8	8.2±3.2	2.7±1.8	0	8±5.4	0	0	0
A.D. farina	27.4±5.2	17.8±4.5	30.1±5.4	21.9±4.8	44±9.9	0	52±9.9	0
A.P. bibliothecae	9.6±3.4	8.2±3.2	6.8±2.9	0	8±5.4	0	0	0
A.D. Acarus siro	8.2±3.2	8.2±3.2	8.2±3.2	1.4±1.4	8±5.4	0	0	0
A.P. pulvini	12.3±3.8	6.8±2.9	2.7±1.8	0	8±5.4	4±3.9	0	0
A. Daphnia magna	11±3.6	9.6±3.4	1.4±1.4	0	8±5.4	0	0	0

Conclusions.

1. The performed study allowed establishing the causally significant allergen from house dust causing atopic dermatitis in children of the certain age and sex group.

2. Prevailing positive reactions in children suffering from atopic dermatitis to A.D. farina enables to develop a preparation for the specific immunotherapy.

3. The obtained negative testing results with allergens from daphniae in most children with AD aged 9 to 12 and 13 to 18 enable to exclude this allergen from the etiological spectrum of atopic dermatitis in children of the above age group.

4. In view of the polyvalent antigen composition of indoor allergens at home, the initial elimination of triggers from the environment of children with atopic dermatitis should be considered most effective.

References

1. Zajkov, S. Opportunities of the elimination therapy of allergic diseases/ S.V.Zaykov, A.P.Grishilo // Asthma and allergy. - № 1. - 2013. - S. 23-31.

2. Baxi, S. N. The Role of Allergen Exposure and Avoidance in Asthma [Text] / S. N. Baxi, W. Phipatanakul // Adolesc Med State Art Rev. – 2010. – 21 (1). – P. 57–72.

3. Gaffin, J. M. The role of indoor allergens in the development of asthma [Text] / J. M. Gaffin, W. Phipatanakul // Curr. Opin. Allergy Clin. Immunol. – 2009. – 9 (2). – P. 128–135.

4. Platts-Mills, T. A. The role of allergens in asthma [Text] / T. A. Platts-Mills, D. Y. Leung, M. Schatz // Am. Fam. Physician. – 2007. – Vol. 76. – P. 650–680.

5. Makeeva N.I. Value of house aeroallergens in the etiological spectrum of bronchial asthma in children / Makeeva N.I., Shmulych V.K. // Annals of Mechnikov Institute. - 2013. – 4. – P. 28- 32.

6. Makeeva N.I. Determining etiologic spectrum of allergic diseases in children depending on sex and age using the nomographic method. / Makeeva N.I., Myasoyedov V.V., Shmulich V.K. // Method Guidelines. - Kyiv, 2013. – P. 43.

7. Pukhlik B.M. Prophylactics of allergic diseases caused by house allergens [Text] / B.M. Pukhlik // Clinical immunology. Allergology. Infectology. – 2009. – № 3 (22). – P. 57–60.

8. Rational pharmacotherapy of allergic diseases: Book for practitioners [Text] / Ed. R.M. Haitova, N. Ilina, T.V. Latysheva, L. Luss, etc. - M.: Litterra, 2007. – 504 p. C: 616.248-053.2-022.854.

9. Application Guidelines “Non-Infectious Domestic Allergens” approved by Order of the Ministry of Health of Ukraine # 197 dd. March 05, 2010. State registration certificate #198/10-300200000 dd. March 05, 2010.

Шмуліч В.К., Уриваєва М.К., Лупальцова О.С., Старусева В.В., Рибка О.С., Шмуліч О.В., Кривенко Л.С.

Порівняльна характеристика значущості побутових алергенів в етіології атопічного дерматиту у дітей.

Харківський національний медичний університет, Україна

Резюме. Методом prick-test обстежено 438 дітей віком від 4 до 18 років, хворих на атопічний дерматит у період стійкої ремісії встановлено перевагу у захворюваності атопічним дерматитом серед дітей дошкільного та раннього шкільного віку. Серед шкірних акаріазів превалюютьвикликані кліщами роду Dermatophagoides farina, що може бути використано з метою оптимізації специфічної імунотерапії атопічного дерматиту у дітей. Діти старшого шкільного віку найменш чутливі до A.Daphnia magna. Доказана доцільність стартової елімінаційної терапії.

Ключові слова: атопічний дерматит, побутові алергени, діти.

Шмулич В.К., Урываева М.К., Лупальцова О.С., Старусева В.В., Рыбка Е.С., Шмулич О.В., Кривенко Л.С.

Сравнительная характеристика значимости бытовых аллергенов в этиологии атопического дерматита у детей.

Харьковский национальный медицинский университет, Украина

Резюме. Методом prick-test обследовано 438 детей в возрасте от 4 до 18 лет, больных атопическим дерматитом в фазе стойкой ремиссии в течении заболевания. Установлено преобладание в заболеваемости атопическим дерматитом детей дошкольного и раннего школьного возраста. Среди кожных акориазов преобладают вызванные клещами рода Dermatophagoides farina, что может быть использовано с целью оптимизации специфической иммунотерапии атопического дерматита у детей. Дети старшего школьного возраста наименее чувствительны к A.Daphnia magna. Доказана необходимость в стартовой элиминационной терапии.

Ключевые слова: атопический дерматит, бытовые аллергены, дети.

Received: 15.12.2014 *Accepted: 3.03.2015*