

ANALYSIS OF THE POSITIVITY RATE IN IGE POSITIVE PATIENTS TO INHALANT ALLERGENS IN VERONA HOSPITAL LABORATORY DURING 2002-2003

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SUMMARY:

Background: At present test tube allergy diagnosis is becoming increasingly more comparable to skin prick tests and is therefore increasingly more reliable, not only from an analytical point of view but also from a clinical one. The cost of test tube allergens has decreased over the years and the specific IgE dosage can quickly give a good diagnostic indication.

Objective: To study the percentage of positive subjects for each individual allergen in cases of suspected allergy, the laboratory can easily identify, also by age bracket, the positivity for those well known allergens that are more commonly responsible for allergic pathologies by using the skin prick test. Our laboratory has studied the test tube diagnostic activity of 2002 and 2003. The inhaled allergens used to identify the positivity percentage were selected from those in our Allergy Unit and which literature identifies as those more commonly positive at skin prick tests.

Methods: The positivity rate of specific IgEs (UniCAP100- Phamarcia) were analyses for two age brackets before and after the age of 12. The younger than 12 group was then subdivided further into pre-school age (3-5 years) and school age (6-12).

Results: It can be stated that in the grass group, the seasonal allergens, the most commonly positive were cereals and pel-litory, the latter increasing in adult age (above 12 years). In the tree group of seasonal allergens, positivity was found to increase in adult age for olive and cypress trees.

The more commonly positive perennial allergens in the adult age (above 12) are dermaphagoides and cat. Below 12, there is a strong positivity to alternaria.

Conclusions: Such test tube studies on IgE positivity are not only useful for better defining diagnostic patterns to give an initial idea of suspected allergy, but also to highlight any changes in the IgE antibody count within different age brackets, with the possibility of documenting the progress of the pathology which is characteristic of the allergy in question.

Key-words: specific IgE - Age - Inhaled allergens.

INTRODUCTION

In recent years it has become possible to dose specific IgEs on blood samples with reliable and reproducible methods. This technological improvement is not only due to the purification and standardisation of those allergens that are more greatly involved in allergic diseases but also to the technological reliability of automated equipment, which is precise and quick in giving answers (1-2).

As a consequence, there has been an increase in the costs of this type of diagnostics, not so much due to the relative increase in demand but because of the research needed to better identify, also by test tube, the allergen responsible for the symptoms whenever skin prick tests cannot be carried out (3-4).

Given that an allergy control and skin prick tests are always the reference to which specific IgE test tube allergy diagnostics must be compared (5-6), the labora-

tory increasingly finds itself having to answer an initial question of suspected allergy (7). For this reason our laboratory decided to study the positivity rate of respiratory allergens by age bracket in order to optimise test tube allergy diagnostics and to highlight any modification in allergic reactivity, within these critical age brackets, that can be identified due to changes in environmental exposure to allergens in atopic subjects (4-7).

MATERIALS AND METHODS

The dosing method of the specific IgEs used by our laboratory is carried out with a UniCap100 (PHARMACIA) instrument, which adopts the immunometric method with fluorimetric reading (8).

THE OBSERVATION PERIOD

The specific IgE dosages were measured over a period of two years from January 2002 to December 2003.

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The allergens considered were selected from the most commonly positive ones identified with skin prick tests and indicated in literature (9-10) (table 1).

STATISTICAL ANALYSIS

The Master-Cap statistical programme by PHARMA-CIA was used to highlight the age bracket and the IgE positivity for the individual allergens.

The result was considered positive for > 0.35 KU/L IgE values. The age brackets taken into consideration

during the two-year period 2002-2003 were below and above 12 years.

In the analysis of the 2002-2003 period, as well as the positivity for patients above the age of 12, the below 12 bracket was further differentiated into age groups: 6-12 years, 3-5 years and under 3 (10-11).

RESULTS

From the specific IgE positivity analysis (>0.35KU/L values) for 2002 and 2003, for those subjects older than 12 years (table2) higher percentages resulted (>30%) for dermatophagoides (d1, d2), cereals (g2, g5, g6), trees such as the olive (t9) and hazel (t4), and pellitory (w19). The positivity percentage for cat (e1) is similar to that of grasses like wormwood (w6), ambrosia (w1) and ribwort (w9) and was lower for some trees like birch (t3), willow (t12) and cypress (t23).

In the age bracket between 3 and 12 years (table 3) it can be noted that the highest positivity (20%) is for dermatophagoides (d1,d2), cereals (g2, g5, g6) and trees: hazel (t4) and olive (t9).

.d1 dermatophagoides pt.	.t9 olive (olea europea)
.d2 dermatophagoides farinae	.t11 plane-tree (platanus acerifolia)
.i6 German cockroach	.t12 willow (Salix caprea)
.e1 cat dandruff	.t23 cypress(cupressus sempervirens)
.e5 dog dandruff	.w1 artemisia (ambrosia elatior)
.g2 Bermuda gras	.w6 wild wormwood (ambrosia elatior)
.g5 sickle grass	.w9 ribwort plantain (plantago lanceolata)
.g6 timothy grass	.w10 pigweed (chenopodium album)
.m3 aspergillus fumigatus	.w14 amaranth (amaranthus retroflexus)
.m6 alternaria alternata	w19 pellitory (parietaria officinalis)
.t3 birch (betula verrucosa)	
.t4 hazel (corylus avellana)	

Table 1.

Allergen code.	Number of tests 2002-2003:	Tests with > 0.35 KU/L IgE	% of tests with >0.35 KU/L IgE
D1	2067	674	33
D2	2070	628	30
I6	749	122	16
E1	1808	407	23
E5	648	65	10
G2	2003	684	34
G5	1389	563	41
G6	942	424	45
M3	1783	219	12
M6	1825	261	14
T3	1873	472	25
T4	773	232	30
T9	1680	519	31
T11	397	83	21
T12	549	144	26
T23	675	187	28
W1	1693	432	26
W6	1778	451	25
W9	717	185	26
W10	194	40	21
W14	410	83	20
W19	1880	574	30

Table 2: IgE positive in patients > 12 years of age in 2002-2003.

Allergen code.	Number of tests 2002-2003:	Tests with > 0.35 KU/L IgE	% of tests with >0.35 KU/L IgE	% difference with patients >12 years
D1	670	160	24	9
D2	662	156	24	6
I6	192	12	6	10
E1	634	87	14	9
E5	234	18	8	2
G2	653	154	24	10
G5	532	168	31	10
G6	234	86	37	8
M3	626	64	10	2
M6	633	100	16	-2
T3	630	107	17	8
T4	229	50	21	8
T9	616	132	22	10
T11	176	33	19	2
T12	171	32	19	7
T23	189	31	16	12
W1	535	82	15	11
W6	578	84	15	10
W9	221	38	17	9
W10	175	32	18	3
W14	178	32	18	2
W19	635	97	15	15

Table 3: IgE positive in patients from the age of 3 to 12 in 2002-2003.

Cat (e1) and pellitory (w19) have an average percentage of 14%. Considering the differences in percentages between the two age brackets above and below 12 years, it may be said that in the adult age group, there is an increase of about 15% for pellitory (w19). There is an average 10% increase for allergens such as: cereals (g2, g5, g6), cat (e1), German cockroach (i6), trees like: birch (t3), hazel (t4), olive (t9), willow (t12), cypress (t23) and grasses such as: wormwood (w6), ribwort (w9) and artemisia (W1).

The age group below 12 was further analysed by subdividing it into patients from 6-12 and patients from 3-5 years of age.

In the school age group (6-12) it can be noted (Table 4) that the highest percentages, 30-40%, are given by dermatophagoides (d1, d2), cereals (g2, g5, g6) and trees like hazel (t4) and olive (t9). Approximately 20% are represented by alternaria (m6), birch (t3) and the other trees and ambrosia (w1) and all the other grasses. Cat (e1) and aspergillus (m3) are around 15%.

In the pre-school age group (3-5) there are positivities (table 5) with percentages around 15% for dermato-

phagoides (d1, d2) and cereals (g2, g5, g6). Other high percentages are for trees such as the plane (t11) and willow (t12) and grasses like wormweed (w6), ribwort (w9), pigweed (w10) and amaranth (w14). Comparing the two age brackets, pre-school and school, the highest increase, about 20%, is for dermatophagoides (d1, d2), cereals (g2, g5, g6), alternaria (m6), birch (t3), hazel (t4) and olive (t9).

For the under 3s (table 6), it can be stated that the only positivity to date found were for dermatophagoides (d1, d2), cereals (g5, g6), alternaria (m6) and wormwood (w6).

DISCUSSION

The allergen positivity percentages were then taken considered in the classic manner of distinguishing between perennial allergens: dermatophagoides (d1, d2), cockroach (i6), cat (e1), dog (e5), moulds (m3 and m6), seasonal allergens, the latter being differentiated between grasses (g2, g5, g6, w1, w6, w9, w10, w14, w19) and trees (t3, t4, t9, t11, t12, t23).

Allergen code.	Number of tests	Tests with > 0.35 KU/L IgE	% of tests with >0.35 KU/L IgE
D1	416	129	31
D2	415	128	31
I6	140	8	6
E1	392	67	17
E5	164	13	8
G2	407	128	31
G5	332	138	42
G6	160	71	44
M3	387	56	14
M6	396	88	22
T3	396	93	23
T4	160	45	28
T9	383	113	30
T11	126	26	21
T12	123	25	20
T23	138	27	20
W1	346	71	21
W6	356	70	20
W9	154	31	20
W10	127	25	20
W14	129	25	19
W19	394	80	20

Table 4: IgE positive in patients between the age of 6-12 years in 2002-2003.

Allergen code.	Number of tests	Tests with > 0.35 KU/L IgE	% of tests with >0.35 KU/L IgE	% difference with patients >12 years
D1	245	31	13	18
D2	247	28	11	20
I6	52	4	8	-2
E1	242	20	8	9
E5	70	5	7	1
G2	246	26	11	20
G5	200	33	17	25
G6	74	15	20	24
M3	239	8	3	11
M6	237	12	5	17
T3	234	14	6	17
T4	69	5	7	21
T9	233	19	8	22
T11	50	7	14	7
T12	48	7	15	5
T23	51	4	8	12
W1	209	11	5	16
W6	222	14	6	14
W9	67	7	10	10
W10	48	7	15	5
W14	49	7	14	5
W19	241	17	7	13

Table 5: IgE positive in patients between the ages of 3-5 in 2002-2003.

■ **Perennial allergens:** it can be stated that the most commonly positive allergens for the over 12 age bracket (fig. 1) are dermatophagoides (d1, d2) and cat (e1).

For the under 12 bracket (fig. 2) dermatophagoides (d1, d2) and cat (e1) are still predominant but alternaria (m6) is also included. There is a considerable increase (fig.3) after 12 for cockroach (i6) and cat (e1) and a decrease in the positivity percentage is evident for alternaria (m6).

■ **Seasonal allergens:** considering **grasses** and the over 12 age bracket (fig. 4), the highest positivity percentages can be noted for cereals (g2, g5, g6) and pellitory (w19). Under 12 (fig. 5) the highest positivity is only for cereals (g2, g5, g6).

The most pronounced increase (fig. 6) for the over 12 age bracket can be seen for pellitory (w19) followed by ambrosia (w1) and artemisia (w6).

Considering the positivity percentages for **trees**, the highest for the over 12s (fig. 7) is for hazel (t4), olive (t9) and cypress (t23).

Both hazel (t4) and olive (t9) are also high for the under 12 age bracket (fig. 8). However, the most evident increase in positivity for the over 12s can be seen for cypress (t23) (fig. 9). The analysis was then taken further for the under 12 age bracket by distinguishing between pre-school age (3-5 years old) and school age (6-12).

While for the under 5s there is a certain homogeneity in the positivity percentages for **perennial allergens** (fig. 10), there is a considerable increase for dermatophagoides (d1, d2), cat (e1) and moulds (m3, m6) after that age. As regards **seasonal allergen grasses**, in the under 5 age bracket, cereals (g2, g5, g6), ribwort (w9), pigweed (w10) and amaranth (w14) give the most common positivities, while above that age there is a considerable increase in positivities for cereals (g2, g5, g6) and all the other grasses (fig. 11).

■ **Trees:** (fig. 12) While the plane-tree (t11) and willow (t12) in the under 5 age bracket have a higher positivity percentage, in the school age bracket, considerable positivities appear for birch (t3), olive (t9), hazel (t4) and cypress (t23).

Allergen code.	Number of tests	Tests with > 0.35 KU/L IgE	% of tests with >0.35 KU/L IgE
D1	116	2	1.7
D2	108	1	1.0
I6	12	0	0
E1	116	0	0
E5	10	0	0
G2	117	0	0
G5	95	3	3.2
G6	16	1	6.3
M3	108	0	0
M6	106	1	1.0
T3	104	0	0
T4	12	0	0
T9	111	0	0
T11	12	0	0
T12	12	0	0
T23	12	0	0
W1	95	0	0
W6	100	1	1.0
W9	12	0	0
W10	12	0	0
W14	12	0	0
W19	114	0	0

Table 6: IgE positive in patients between the ages of 0-2 in 2002-2003.

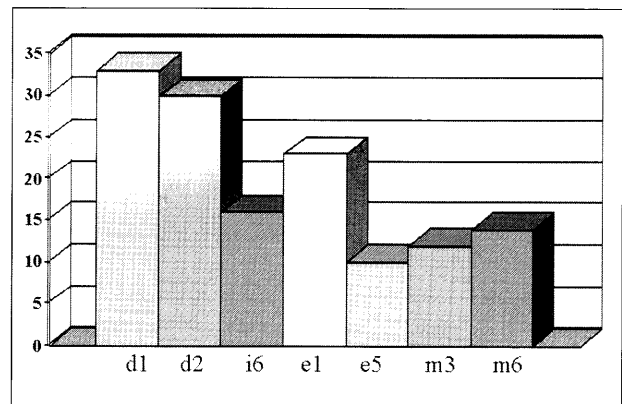


Fig. 1: % IgE positive "perennial allergens" in patients >12 years of age in 2002-2003.

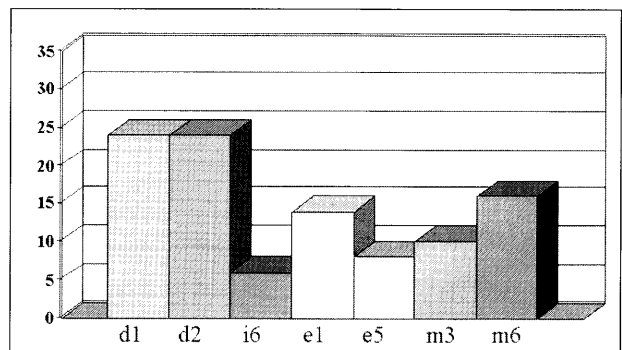


Fig. 2: % IgE positive "perennial allergens" in patients <12 years of age in 2002-2003.

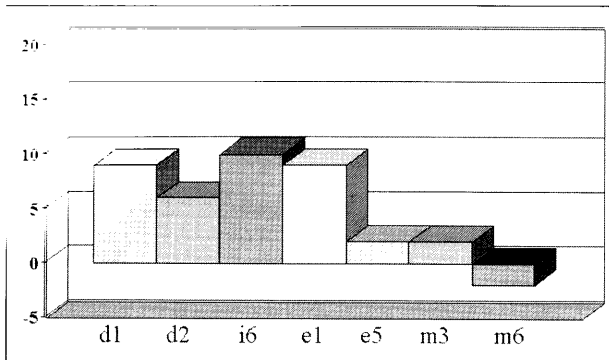


Fig. 3: Perennial allergens: % difference between patients >12 years of age and those <12.

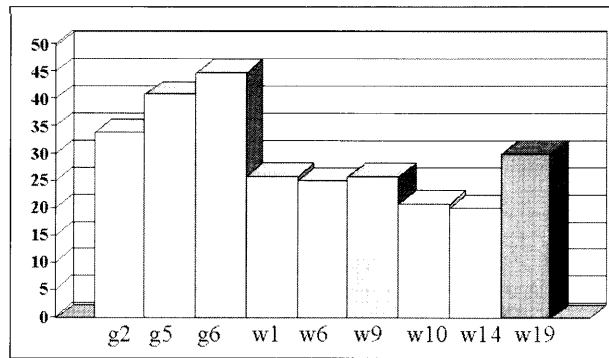


Fig. 4: % IgE positive "seasonal allergens: grasses" in patients >12 years of age in 2002-2003.

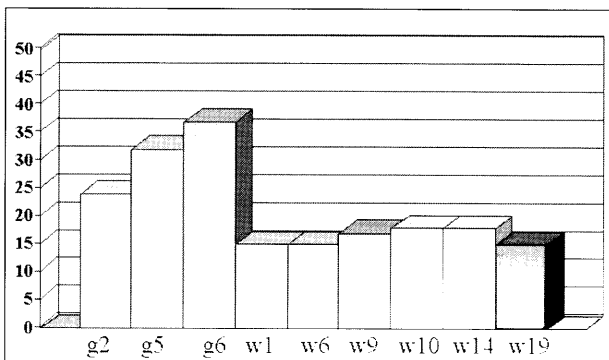


Fig. 5: % IgE positive "seasonal allergens: grasses" in patients <12 years of age in 2002-2003.

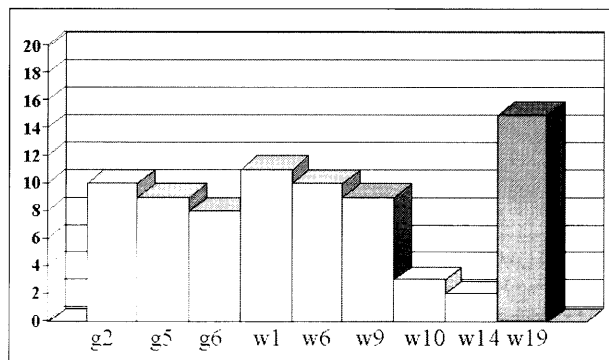


Fig. 6: Seasonal grass allergens: % difference between patients >12 years of age and those <12.

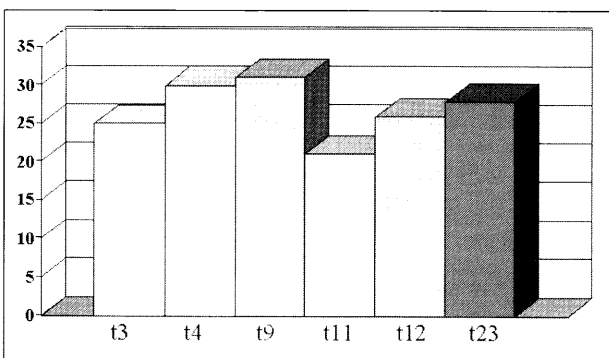


Fig. 7: % IgE positive "seasonal allergens: trees" in patients >12 years of age in 2002-2003.

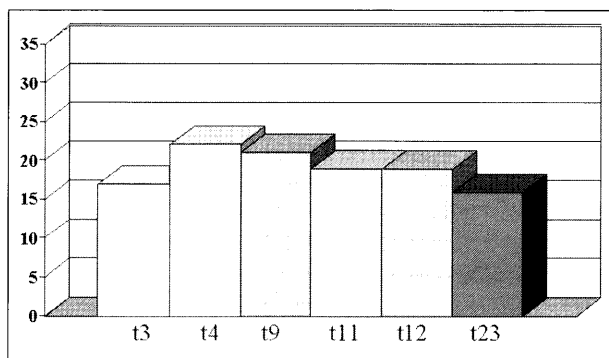


Fig. 8: % IgE positive "seasonal allergens: trees" in patients <12 years of age in 2002-2003.

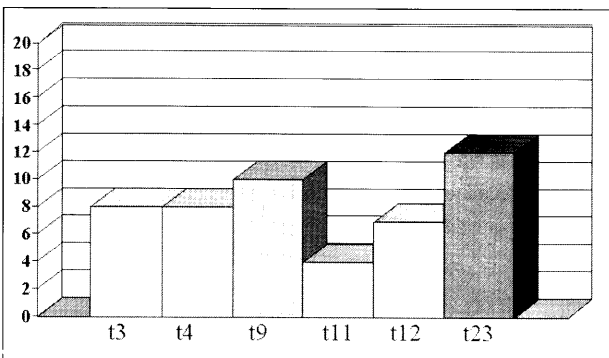


Fig. 9: Seasonal tree allergens: % difference between patients >12 years of age and those <12.

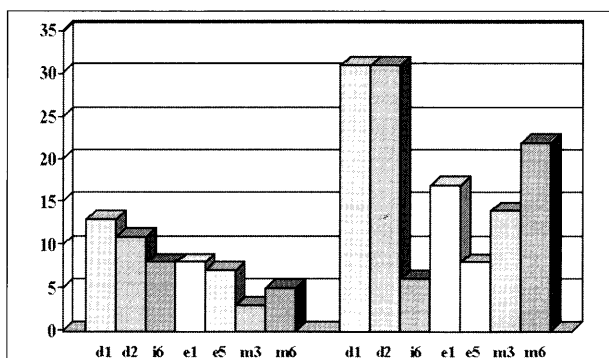


Fig. 10: % specific IgEs for perennial allergens is 5 years the critical age?

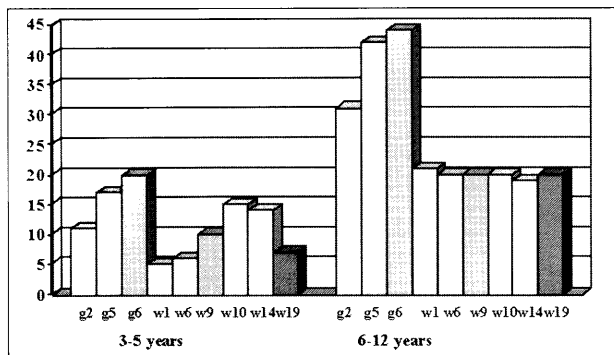


Fig. 11: % specific IgE for grasses is 5 years the critical age?

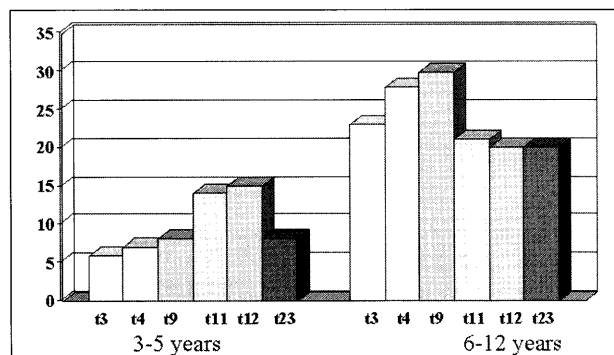


Fig. 12: % specific IgE for tree is 5 years the critical age?

CONCLUSIONS

Analysis of the positivity percentages can be useful to improve test tube diagnostics for specific IgEs. The study of positivity percentages with statistical systems connected to analysers leads to a more profound analysis of the mediate allergic IgE reactivity in the population of the geographical area concerned. Diagnostic Allergy Units in the future will have to investigate further to identify more complex diagnostic pathologies with allergens that are a lot less common within the population but not in the least less serious (12-13-14).

References

1. Williams P.-B., Barnes J.-H., Szeinbach S.L., Sullivan T.-J.. - Analytic precision and accuracy of commercial immunoassay for specific IgE: establishing a standard. *J Allergy Clin Immunol* 2000;105:1121-30.
2. Szeinbach S.-L., Barnes J.-H., Sullivan T.-J., Williams P.-B. - Precision and accuracy of commercial laboratories' ability to classify positive and/or negative allergen-specific IgE results. *Ann Allergy Asthma Immunol* 2001;86: 373-381.
3. Host A., Andrae S., Charkin S., Diaz-Vazquez C., Dreborg S., Eigenmann P.A., Friedrichs F., Grinstead P., Lack G., Meylan G., Miglioranza P., Muaro A., Nieto A., Niggemann B.-M., Pascual C., Pouech M.-G., Rancé F., Rietschel E., Wickman M. Allergy testing in children: why, who, when and how? *Allergy* 2003;58:1-11.
4. Plebani M. - Clinical value and measurement of specific IgE. *Clinical Biochemistry* 2003;36: 453-469.
5. Soderstrom L., Kober A., Ahlstedt S., de Groot H., Lange C.-E., Paganelli R., Roovers M.H.W., Sastre J. - A further evaluation of clinical use of specific IgE antibody testing in allergic diseases. *Allergy* 2003;58(9):921-8.
6. Dolen W. - IgE antibody in the serum - detection and diagnostic significance. *Allergy* 2003;58:717-723.
7. Yunginger J.-W., Ahlstedt S., Eggleston P.-A., Homburger H.-A., Nelson H.-S., Owby D.-R., Platts-Mills T.-A., Sampson H.-A., Sicherer S.-H., Weinstein A.-M., Williams P.-B., Wood R.-A., Zeiger R.-S. - Quantitative IgE antibody assay in allergic diseases. *J Allergy Clin Immunol* 2000;105:1077-84.
8. Paganelli R., Ansotegui I.-J., Sastre J., Lange C.-E., Roovers M.H.W., de Groot H., Lindholm N.-B., Evan P.-W. - Specific IgE antibodies in the diagnosis of atopic disease: clinical evaluation of a new in vitro test system, UniCAP, in six European allergy clinics. *Allergy* 1998;53:763-8.
9. Bauchau V., Durham S.-R. - Prevalence and rate of diagnosis of allergic rhinitis in Europe. *Eur Respir J* 2004;24:758-764.
10. Isolauri E., Huurre A., Salminen S., Impivaara O. - The allergy epidemic extends beyond the past few decades. *Clin Exp Allergy* 2004; 34:1007-1010.
11. Williams L.-K., Peterson E.-L., Ownby D.-R., Johnson C.-C. - The relationship between early fever and allergic sensitization at age 6 to 7 years. *J Allergy Clin Immunol* 2004;113:291-6.
12. Ahlstedt S. - Understanding the usefulness of specific IgE blood tests in allergy. *Clin Exp. All* 2002;32:11-16.
13. Williams P.-B. - Usefulness of specific IgE antibody tests: a progress report. *Ann Allergy asthma Immunol* 2003;91:518-524.
14. Malindian H. - The clinical use of specific IgE antibody testing - a further word of caution. *Allergy* 2004;59:359-361.