

ORIGINAL ARTICLE

Evaluation of Skin Prick Test Results Performed for the Diagnosis of Inhaled Allergens in Konya

Konya ilinde Solunum Alerjenleri Tanısı İçin Yapılan Deri Prick Testi Sonuçlarının Değerlendirilmesi

¹Bahar Ürün Ünal , ¹Ayşe Can Erçin , ²İlknur Külhaş Çelik , ²Hasibe Artaç 

¹Selçuk University Medical Faculty, Department of Family Medicine, Konya, Türkiye
²Selçuk University Medical Faculty, Division of Pediatric Immunology and Allergy, Konya, Türkiye

Correspondence

Bahar Ürün Ünal, Selçuk University Medical Faculty, Department of Family Medicine, Konya, Türkiye

E-Mail: urunbahar@gmail.com

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ABSTRACT

Objective: We aimed to determine the distribution of inhaled allergens by evaluating the results of skin prick tests performed on patients with allergic complaints in Konya.

Material and Methods: The study included 2351 patients aged 2-18 years who underwent skin prick tests for the diagnosis of inhaled allergens at the Selçuk University Medical Faculty Pediatric Allergy and Immunology Outpatient Clinic between June 1, 2022, and May 31, 2023. The demographic characteristics and skin prick test results of 696 patients with sensitivity to at least one inhaled allergen were retrospectively evaluated.

Results: Sensitivity to at least one inhaled allergen was detected in 696 (29.6%) of 2351 patients who underwent skin prick testing for allergic symptoms. The mean age of patients with inhaled allergen sensitivity was 10.37 ± 4.14 years. 278 (39.9%) of the patients were girls, and 418 (60.1%) were boys. Considering the distribution of inhaled allergens detected by the skin prick test, the most frequent allergens were pollen allergens (78.2%), cat epithelium (38.8%), and dog epithelium (33.8%). The most common allergens detected in girls were pollen allergens (77.3%), cat epithelium (38.1%) and house dust mites (37.1%). The most common allergens detected in males were pollen allergens (78.7%), cat epithelium (39.2%), and dog epithelium (34.7%). Sensitivity to house dust mites was more prevalent in girls than boys. Sensitivity to pollen allergens was most frequently detected in all seasons. Significant differences were detected between house dust mites, pollen allergens, rye, and cat epithelium sensitivities according to seasons.

Conclusion: Our study shows the distribution of inhaled allergens in Konya province. Therefore, we assume that it can contribute to the implementation of environmental measures that can be taken to protect against allergens and, thus, to the treatment of patients.

Keywords: Allergen, Skin prick test, Sensitivity.

ÖZ

Amaç: Konya ilinde alerjik şikayetleri olan hastalara uygulanan deri prick testi sonuçlarını değerlendirilerek inhaler alerjenlerin dağılımını tespit etmeyi amaçladık.

Gereç ve Yöntem: Çalışmaya Selçuk Üniversitesi Tıp Fakültesi Hastanesi Çocuk Alerji ve İmmünoloji polikliniğine 1 Haziran 2022-31 Mayıs 2023 tarihleri arasında solunum alerjenleri tanısı için deri prick testi yapılan 2-18 yaş arası 2351 hasta dahil edildi. Bu hastalardan en az bir inhaler alerjene duyarlılık saptanan 696 hastanın demografik özellikleri ve deri prick testi sonuçları retrospektif olarak değerlendirildi.

Bulgular: Alerjik şikayetler nedeniyle deri prick testi uygulanan 2351 hastanın 696'sında (%29.6) en az bir inhaler alerjene karşı duyarlılık saptanmıştır. Inhaler alerjen duyarlılığı saptanan hastaların yaş ortalaması 10,37 ± 4,14 olup hastaların 278'i (%39,9) kız, 418'i (%60,1) erkektir. Deri prick testi ile saptanan inhaler alerjenlerin dağılımına bakıldığında en sık polen alerjenleri (%78,2), kedi epiteli (%38,8) ve köpek epiteli duyarlılığı (%33,8) gözlemlendi. Kızlarda en sık saptanan alerjenler polen alerjenleri (%77,3), kedi epiteli (%38,1), ev tozu akarları (%37,1) olarak tespit edildi. Erkeklerde en sık saptanan alerjenler polen alerjenleri (%78,7), kedi epiteli (%39,2) ve köpek epiteli (%34,7) olarak tespit edildi. Saptanan alerjen duyarlılıkları cinsiyete göre değerlendirildiğinde; kızlarda ev tozu akarlarına karşı duyarlılık saptanması erkeklere göre daha yüksek oranlardadır. Tüm mevsimlerde en sık polen alerjenlerine karşı duyarlılık tespit edildi. Mevsimlere göre ev tozu akarları, polen alerjenleri, çavdar, çimen ve kedi epiteli duyarlılığı arasında istatistiksel olarak anlamlı farklılık saptandı.

Sonuç: Çalışmamızın Konya ilinde inhaler alerjenlerin dağılımını göstermesi nedeniyle alerjiden korunmak için alınabilecek çevresel önlemlerin uygulanmasına ve bu sayede hastaların tedavisine katkıda bulunabileceğini düşünmekteyiz.

Anahtar Kelimeler: Alerjen, Deri prick testi, Duyarlılık

Introduction

Allergy is a hypersensitivity reaction that develops against a specific immunological trigger (1). The prevalence of allergic diseases has increased over the past decade, adversely affecting the lives of patients and their families (2). Respiratory allergies are common in all age groups, and their frequency is increasing (3). In addition to genetic factors, environmental factors also play a role in the development of allergies (4). Sensitivity to inhaled allergens may vary by geographic region (5). Geographical factors such as climate,

vegetation, humidity, and sea level, as well as seasonal changes, are important in the distribution of inhaled allergen sensitivities (6).

Since their invention by Charles Harrison Blackley in 1865, skin tests have been the main method used to investigate allergies (7,8). Due to their low cost, ease of use, and rapid results in detecting allergen sensitivities in Type I hypersensitivity reactions such as asthma, allergic rhinitis, atopic dermatitis, anaphylaxis, and eosinophilic

gastritis, skin prick tests are often preferred in clinical practice (9,10,11).

In our country, the distribution of inhaled allergens varies among regions. In this study, we aimed to evaluate the distribution of inhaled allergens determined by skin prick test in patients presenting with allergic complaints in Konya.

Material and Methods

Patients between the ages of 2 and 18 who underwent skin prick testing for the diagnosis of inhaled allergens at the Pediatric Allergy and Immunology Clinic of Selçuk University Medical Faculty between June 1, 2022, and May 31, 2023, were included in the study. Demographic characteristics and skin prick test results of patients with sensitivity to at least one inhaled allergen were retrospectively evaluated.

Skin prick tests were performed with solutions from Allergopharma® (Hamburg, Germany), and Lofarma® (Milan, Italy). Before the test, antihistamines were discontinued 15 days before, antidepressants were discontinued 1 week before, and medications containing montelukast were discontinued 3 days before. Histamine solution (10mg/ml) was used as a positive control and saline solution as a negative control in the skin prick test. Allergen solutions were applied to the volar surface of the forearm with a lancet. A positive reaction was considered if a wheal of 3 mm or greater, was observed 15 minutes after the application of allergen solutions, compared with the negative control (12). Inhaled allergens used in the skin prick test included house dust mites (*Dermatophagoides farinae*, *Dermatophagoides pteronyssinus*), pollen allergens (birch, rye, grass mix (orchard grass, tussac grass, blue fescue, grass), weed mix (cart-track, *Xanthium strumarium*, weed)), cat epithelium, dog epithelium, molds (*Alternaria alternata*, *Aspergillus fumigatus*, and *Cladosporium herbarum*) and cockroach.

The study was approved by the Selçuk University Faculty of Medicine Local Ethics Committee with decision No. 2023/93, dated August 1, 2023.

Statistical Analysis

Data were analyzed using the SPSS 25 statistical software package. Descriptive statistics were provided, including percentages, means and standard deviations. Categorical data were evaluated using Fisher's exact chi-squared test or Pearson's chi-squared test in contingency tables. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 2351 patients aged 2–18 years underwent skin prick testing for inhaled allergens between May 1, 2022, and June 30, 2023. Among these patients, 696 (29.6%) were sensitive to at least one inhaled allergen. Of these, 28.4% were monosensitized (sensitive to a single inhaled allergen), while 71.6% were polysensitized (sensitive to multiple inhaled allergens). The mean age of patients with inhaled allergen sensitivity was 10.37 ±

4.14 years. 278 (39.9%) of the patients were girls, and 418 (60.1%) were boys. The mean age was 11.09 ± 4.13 years for the girls, and 9.89 ± 4.09 years for the boys.

Among the inhaled allergens identified by the skin prick test, sensitivity to the pollen allergens was the most common (78.2%). The following sensitivities to pollen allergens mixes were observed: grass mix (55.2%), rye (53.9%), weed mix (48.1%) and birch (20%). The second and third most common sensitivities were cat epithelium (38.8%) and dog epithelium (33.8%). Sensitivities to house dust mites (32.3%), *Alternaria alternata* (28.7%) and cockroach (28.0%) were also observed. Sensitivity to *Aspergillus fumigatus* and *Cladosporium herbarum* was observed in 377 patients, with values of 7.5% for both. The distribution of allergen sensitization with the skin prick test is presented in Figure 1.

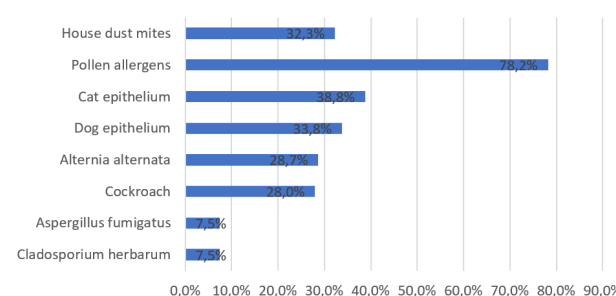


Figure 1: The distribution of allergen sensitivities identified by the skin prick test

When evaluating skin prick test results by gender, the most common allergens in girls were (77.3%), cat epithelium (38.1%) and house dust mites (37.1%). In boys, the most common allergens were pollen allergens (78.7%), cat epithelium (39.2%), and dog epithelium (34.7%). Regarding gender differences, girls exhibited a higher sensitivity to house dust mites compared to boys ($p < 0.05$). Table 1 shows the distribution of skin prick test-identified allergen sensitization by gender.

When evaluating skin prick test results by season, sensitivity to was most frequently observed in all seasons of the year. In summer, sensitivity to pollen allergens (83.3%), cat epithelium (34.9%), and *Alternaria alternata* (27.1%) were the most common. In autumn, sensitivity to pollen allergens (81.3%), house dust mites (40.3%) and cat epithelium (39.2%) were prominent. In winter, sensitivity to pollen allergens (70.8%), house dust mites (41.5%) and cat epithelium (31%) prevailed, while in spring, sensitivity to pollen allergens (76.4%), cat epithelium (51.6%) and cockroach (35%) were prominent. The evaluation of skin prick test positivity by season is presented in Table 2. There were no statistically significant differences in sensitivity among birch, weed mix, dog epithelium, *Alternaria alternata*, cockroach, *Aspergillus fumigatus*, and *Cladosporium herbarum* ($p > 0.05$). However, there was significant differences in sensitivity according to the season for house dust mites ($p < 0.001$), pollen allergens ($p = 0.021$), rye ($p < 0.001$), grass mix ($p < 0.001$) and cat epithelium ($p = 0.001$). In pairwise comparisons, sensitivity to house

Table 1: The distribution of sensitivities to allergens identified by the skin prick test according to gender

Allergens	Total (n=696)		Girls (n=278)		Boys (n=418)		p Value
	Number	%	Number	%	Number	%	
House dust mites	225	32.3	103	37.1	122	29.2	0.030*
D. farinea	134	19.3	60	21.6	74	17.7	0.204
D. pterinus	166	23.9	78	28.1	88	21.1	0.034**
Pollen Allergens	544	78.2	215	77.3	329	78.7	0.668
Birch	139	20	50	18	89	21.3	0.285
Rye	375	53.9	140	50.4	235	56.2	0.129
Grass mix	384	55.2	155	55.8	229	54.8	0.801
Weed mix	335	48.1	129	46.4	206	49.3	0.456
Cat epithelium	270	38.8	106	38.1	164	39.2	0.770
Dog epithelium	235	33.8	90	32.4	145	34.7	0.527
Alternaria alternata	200	28.7	76	27.3	124	29.7	0.506
Cockroach	195	28	69	24.8	126	30.1	0.126
Aspergillus fumigatus	52 (n=377)	7.5	19 (n=157)	6.8	33 (n=220)	7.9	0.421
Cladosporium herbarum	52 (n=377)	7.5	18 (n=157)	6.5	34 (n=220)	8.1	0.268

Note: *D. pterinus*: *Dermatophagoides pterinus* *D. farinea*: *Dermatophagoides farinea*

*,** Girls exhibited a higher sensitivity compared to boys ($p < 0.05$).

Table 2: Evaluation of skin prick test positivity by season

Allergens	Summer (n=192)		Autumn (n=176)		Winter (n=171)		Spring (n=157)		p Value
	Number	%	Number	%	Number	%	Number	%	
House dust mites	37	19.3	71	40.3	71	41.5	44	28	<0.001 ¹
D. farinea	27	14.1	38	21.6	41	24	28	17.8	0.086
D. pterinus	34	17.7	54	30.7	50	29.2	28	17.8	0.002 ²
Pollen Allergens	160	83.3	143	81.3	121	70.8	120	76.4	0.021 ³
Birch	37	19.3	34	19.3	31	18.1	37	23.6	0.628
Rye	127	66.1	91	51.7	77	45	80	51	<0.001 ⁴
Grass mix	128	66.7	94	53.4	72	42.1	90	57.3	<0.001 ⁵
Weed mix	90	46.9	97	55.1	73	42.7	75	47.8	0.133
Cat epithelium	67	34.9	69	39.2	53	31	81	51.6	0.001 ⁶
Dog epithelium	67	34.9	61	34.7	46	26.9	61	38.9	0.133
Alternaria alternata	52	27.1	56	31.8	40	23.4	52	33.1	0.177
Cockroach	43	22.4	50	28.4	47	27.5	55	35	0.076
Aspergillus fumigatus	0 (n=0)	0	5(n=49)	2.8	21	12.3	26	16.6	0.392
Cladosporium herbarum	0 (n=0)	0	7(n=49)	4	16	9.4	29	18.5	0.057

1,2 Sensitivity was higher in autumn and winter compared to spring and summer. 3 Sensitivity was higher in summer and autumn compared to winter. 4 Sensitivity was higher in the summer compared to other seasons. 5 Sensitivity was higher in the summer compared to autumn and winter, and in autumn and spring compared to winter. 6 Sensitivity was higher in spring compared to other seasons.

dust mites was higher in autumn and winter compared to spring and summer ($p < 0.05$). Sensitivity to pollen allergens was higher in summer and autumn compared to winter ($p < 0.05$). Rye sensitivity was higher in summer compared to other seasons ($p < 0.05$). Grass mix sensitivity was higher in summer compared to autumn and winter, and in autumn and spring compared to winter ($p < 0.05$). Cat epithelium sensitivity was higher in spring compared to other seasons ($p < 0.05$). There were no statistically significant differences among the other seasons ($p > 0.05$).

Discussion

Environmental factors are also effective in the development of allergies, as well as genetic factors (4). The development of allergic diseases in the respiratory tract can result from our environment's exposure to inhaled allergens. Exposure to these aeroallergens

also leads to exacerbation of symptoms (13). Inhaled allergens can be divided into two categories as indoor and outdoor allergens. Indoor allergens include house dust mites, mold fungal spores, pet epithelium and cockroaches while pollen and some fungal spores are classified as outdoor allergens (14).

In our study, sensitization to at least one inhaled allergen was found in 29.6% of patients who underwent skin prick testing due to allergic complaints. Different rates have been reported in similar studies conducted in our country. Sensitization to at least one inhaled allergen was detected in 59% of patients with allergic complaints in Denizli (15), 59.5% in atopic children in Alanya (16), 42.3% in children with asthma and allergic rhinitis in Karaman (17) and 31.2% in atopic patients in Malatya (18). The variances in the results may be due to the differences in the distribution of allergens in the

region of residence and the patient groups included in the study.

Considering the distribution of inhaled allergens in our study, pollen allergens sensitization was the most common (78.2%). Cat epithelium sensitization (38.8%) and dog epithelium sensitization (33.8%) were observed in the second and third frequencies, respectively. Çölgeçen et al. reported that in Yozgat, the most frequently detected allergens were pine pollen 25.3%, wheat pollen 18.4% and dog epithelium 15.8% (19); Demir et al. stated that in Diyarbakır, the most frequently detected allergens were found to be meadow pollen (70%), wheat pollen (46%) and tree pollen (46%) (20). Ayçin et al. conducted a study in Erzurum in patients with allergic rhinitis and asthma, and determined that the most common sensitization was to mixed grass pollen (30.8%), followed by house dust mites (29.3%). (21). In a study conducted by Sayar on atopic children in the Alanya region, the most common sensitization was observed to mites (76.1%), molds (*Alternaria alternata* (51.8%) and *Cladosporium herbarum* (41.7%)), and pollen sensitization (39.8%) (16). In a study conducted by Havlucu et al. in Hatay, sensitization to house dust mites (48.5%) and grass mixture (39.5%) were the most common (22). The high sensitization to pollen in Konya province, which has a continental climate, is similar to that in Yozgat, Erzurum and Diyarbakır provinces, which also have a continental climate. Mites are found more in warm and humid environments. They can survive best at temperatures between 25 and 30°C and 75-80% humidity. In provinces near the sea level, such as Antalya and Hatay, susceptibility to house dust mites is more common.

Studies have reported that allergic sensitization is more common in the male gender (23,24). In our study, 60.1% of the patients with positive skin prick test results were male and 39.9% were female, compatible with the literature. When skin prick test results were evaluated according to gender, the most common allergens detected in girls were pollen allergens (77.3%), cat allergens (38.1%) and house dust mites (37.1%). The most frequently detected allergens in boys were pollen allergens (78.7%), cat allergens (39.2%) and dog allergens (34.7%). When the detected allergen sensitizations were evaluated according to gender, sensitization to house dust mites was higher in girls than in boys ($p<0.05$).

It has been reported in the literature that house dust mite sensitization is found more frequently in males (25,26). In our study, house dust mite sensitization was found more frequently in girls. In our study, it was determined that sensitivity to pollen allergens occurred most frequently in all seasons. In summer, pollen allergens (83.3%), cat epithelium (34.9%), and *Alternaria alternata* (27.1%) were observed, and pollen allergens (81.3%), house dust mites (40.3%), and cat epithelium (39.2%) were observed in autumn., pollen allergens (70.8%), house dust mites (41.5%), and cat epithelium (31%) occurred in winter, and pollen allergens (76.4%), cat epithelium (51.6%), and

cockroaches (35%) were observed in spring. There was a statistically significant difference between house dust mites, pollen allergens, rye, grass mix and cat epithelium sensitization according to the seasons. In the literature, there are very few studies evaluating the seasonal distribution of inhaled allergen sensitization. Since our study's data set is relatively high compared to other studies and similar studies are limited in the literature, we consider that our research will support the scientific contribution.

Conclusion

As a result, pollen allergens sensitization was found most frequently in Konya. Pollen allergens sensitization was observed most frequently in all seasons. Significant differences were determined among house dust mites, pollen allergens, rye, grass mix and cat epithelium sensitization according to seasons. These insights from this paper can contribute to the formation of the allergen profile of Konya province and to the establishment and evaluation of regional allergen profiles for future studies.

Declaration Conflict of Interest: The authors declare that there is no conflicts of interest.

Ethical Aspects of the Research: The study was approved by the Selçuk University Faculty of Medicine Local Ethics Committee (Decision No. 2023/393, Date: 01.08.2023).

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