doi: 10.30934/kusbed.1177497 **e-ISSN:** 2149-8571

Kocaeli Üniversitesi Sağlık Bilimleri Dergisi

Özgün Araştırma / Original Article

http://dergipark.gov.tr/kusbed

SKIN PRICK TEST REACTIVITY TO COMMON ALLERGENS AMONG ALLERGIC RHINITIS PATIENTS IN KOCAELI PROVINCE, TURKEY

KOCAELİ İLİNDEKİ ALERJİK RİNİTLİ HASTALARIN DERİ PRICK TESTİNDEKI ALERJEN REAKTİVİTELERİ

Atılay Yaylacı*[1]

[1]Kocaeli University, Faculty of Medicine, Department of Otorhinolaryngology, Kocaeli University, Kocaeli, Turkey

ORCID iD: Atılay Yaylacı: 0000-0002-7842-0342

***Sorumlu Yazar / Corresponding Author:** Atılay Yaylacı **e-posta / e-mail:** dratilay@yahoo.com

Geliş Tarihi / Received: 20.09.2022 **Kabul Tarihi / Accepted:** 26.12.2022 **Yayım Tarihi / Published:** 01.02.2023

Abstract

Objective: The identification of the most common aeroallergens causing allergic rhinitis (AR) in a specific geographic area is important in the diagnosis and treatment of AR. This study evaluates the prevalence of sensitivity to aeroallergens among patients with AR who live in Kocaeli province, Turkey.
Methods: This cross-sectional, descriptive study included a retrospective review of skin prick test (SPT) results from patients with suspected AR who were examined at a tertiary hospital rhinology clinic.
Results: The SPT results of 85 patients with an AR diagnosis were included in this study. House dust mites (HDM) had the highest frequency of positive test responses (57.6%), followed by tree pollen (40.0%), grass pollen (36.5%), weed pollen (32.9%), cockroach (18.8%), animal dander (14.1%), and mold (11.8%). The majority of the AR patients were polysensitized (57.6%), and the most common allergens in polysensitized patients were tree pollen (61.2%), grass pollen (57.1%), and HDM (55.1%), respectively. The strongest single allergen in monosensitized subjects was HDM, with a rate of 61.1%.
Conclusion: The most prevalent allergen was HDM among AR patients in the Kocaeli region, followed by tree pollen and grass pollen. Polisensitization occurs more frequently than monosensitization. These allergens should be prioritized in the diagnosis and treatment of allergic rhinitis in Kocaeli region patients.

Keywords: *Allergic rhinitis, allergen prevalences, skin prick test, sensitization, Kocaeli.*

Öz

Amaç: Alerjik rinit (AR)'in tanı ve tedavisinde belirli bir coğrafi bölgedeki AR'yi tetikleyen en yaygın aeroalerjenlerin belirlenmesi önemli bir role sahiptir. Bu çalışma, Kocaeli ilinde yaşayan AR'li hastalarda aeroalerjen duyarlılığının prevalansını değerlendirmektedir.
Yöntem: Bu tek merkezli kesitsel tanımlayıcı çalışma, üçüncü basamak bir hastanenin rinoloji kliniğinde AR öntanısı ile değerlendirilen hastalara ait deri prik testi (DPT) sonuçlarının retrospektif bir incelemesini içermektedir.
Bulgular: AR tanılı 85 hastanın DPT sonuçları analiz edildi. Ev tozu akarları (HDM) en yüksek pozitif test yanıtı sıklığına sahipti (%57.6), bunu ağaç poleni (%40.0), çim poleni (%36.5), yabani ot poleni (%32.9), hamamböceği (%18.8), hayvan tüyü (%14.1) ve küf (%11.8) izledi. Hastaların çoğunluğu polisensitize idi (57.6%) ve bu hastalarda en sık görülen alerjenler sırasıyla ağaç poleni (%61.2), çim poleni (%57.1) ve HDM (%55.1) idi. Monosensitize kişilerde en yaygın tek alerjen %61.1 ile HDM idi.
Sonuç: Kocaeli bölgesinde AR hastaları arasında en sık görülen alerjen HDM'dir, bunu ağaç poleni ve çim polenleri izlemektedir. Polisensitizasyon, monosensitizasyondan daha çok yaygındır. Kocaeli bölgesi hastalarında alerjik rinit tanı ve tedavisinde bu alerjenler öncelikli olarak düşünülmelidir.

Anahtar Kelimeler: *Alerjik rinit, alerjen prevalansı, deri prick testi, duyarlılık, Kocaeli.*

Introduction

Allergic rhinitis (AR) is characterized by nasal congestion, rhinorrhea, sneezing, nasal itchiness, and/or postnasal drip and is caused by immunoglobulin E-mediated reactions to inhaled allergens. AR appears to be the consequence of environmental exposures acting on a pre-existing genetic background.[1] It is a common disease worldwide, affecting 10 to 25% of the population.[2] In Turkey, the prevalence of AR in adult individuals varies between 16.6% and 23.0% depending on location, with the Marmara Region having the highest prevalance.[3] AR has a significant influence on a patient's quality of life and also causes significant costs owing to school or work absenteeism, loss of productivity, and consumption of healthcare resources.[4]

The clinical diagnosis of AR is made by the occurrence of rhinitis symptoms following allergen exposure, and the definitive diagnosis is obtained by demonstrating sensitivity to an allergen on allergy testing.[1] Skin-prick testing (SPT) is a practical, well-tolerated, and highly specific and sensitive test for determining sensitization to inhalant allergens.[5]

Airborne allergens (tree, grass, and weed pollen; molds; house dust mites; and animal dander) are the most prevalent triggers of AR, and their nature and distribution vary within and between countries.[1,6] Because the environmental conditions, vegetation, and climate of each region of Turkey differ, identifying the common aeroallergens triggering AR in a particular region is important in the diagnosis and management of AR. This knowledge can aid in determining the relevant allergen(s) responsible for disease symptoms. For example, given the considerable rate of asymptomatic sensitization in the population, rhinitis symptoms in monosensitized individuals might not be caused by allergen detected on SPT, leading to misdiagnosis. Alternatively, in polisensitized patients, because not all sensitizations are the underlying cause of AR, incorrect detection of the relevant allergen(s) may result in unnecessary avoidance measures that may deteriorate their QOL or inefficient avoidance measures that may result in an unnecessary step-up in AR management. Worse than that, it may cause the initiation of an improper allergy immunotherapy (AIT). In addition, this data can help with the development of more specific allergy panels based on regional patterns of sensitization, allowing for more efficient and cost-effective screening of sensitized patients. Furthermore, this information could lead to pollination studies being conducted based on the most common allergens in the territory, which in turn can help individuals with seasonal AR symptoms receive on-time treatment before the onset of symptoms. Lastly, this data may help in developing environmental control strategies to address AR.

Kocaeli is a metropolitan province located in the Eastern Marmara region of Turkey, with a population of over 2 million people.[7] To date, no research has been conducted to determine the most common allergensin AR patients in this province. The current study aims to analyze skin prick test results to determine the prevalance of reactivity to common allergens among AR patients in Kocaeli.

Methods

SPT results and medical records of all adult patients with suspected AR who were tested in the rhinology clinic of our ENT Department at Kocaeli University between May 2019 and August 2022 were reviewed. The study was approved by the ethical committee of Kocaeli University (number: 2022/15.02–236). Written informed consent was obtained from all participants. The following were the inclusion criteria: (1) patients must be over the age of 18, (2) they must have had rhinitis symptoms (rhinorrhea, sneezing, nasal obstruction, nasal itching) for more than two weeks in the previous year, (3) they must have a positive skin test reactivity on SPT, and (4) they must live in Kocaeli province. Patients who lived outside of Kocaeli and displayed dermographism during the SPT were excluded. Patients were divided into three age groups: 18–35, 36–50, and over 50 years of age. According to the time pattern of symptoms, it was called seasonal allergic rhinitis if the symptoms appeared during a particular season and perennial allergic rhinitis if the symptoms continued persistently all year.

A SPT was used to assess patients' allergen sensitivity in all subjects that presented symptoms suggestive of AR. SPT was performed by the author with a standardized panel including 28 commercial allergenic extracts of common indoor and outdoor airborne allergens: grasses (Mixture of "*Timothy, Orchard, June, Redtop, Meadow Fescue, Perennial Rye*"), trees (Mixture of "*Alder, White Ash, Black Birch, American Elm, Shagbark Hickory, Maple, White Oak, White Poplar, American Sycamore*"; and *Olea europaea)*; weeds (*Lamb's Quarters, English Plantain, Ragweed, Mugwort*), molds (*Aspergillus, Alternaria, Cladosporium*), house dust mites (Mixture of "*Dermatophagoides farinae* and *Dermatophagoides pteryonyssinus*"), animal danders (*Cat, Dog*), and Cockroach. All allergens used were obtained from ALK, Denmark. Allergens in a 50% glycerin solution were applied to the volar forearm with a Multi-Test II® device (Lincoln Diagnostics, Decatur, IL). A negative glycerin control and a positive histamine control were used. The wheal size was measured 15 minutes after application. A positive skin test result was defined as a wheal of >3 mm to any of the allergens with a nonreactive negative control. Sensitization to one allergen in the panel was defined as monosensitization, and sensitization to two or more allergens was defined as polysensitization.[8]

Demographic information (age, gender, and place of residence) as well as the seasonal pattern of symptoms (perennial and seasonal) were retrieved via a standardized data collection form designed specifically for AR patients in our rhinology clinic. The frequency distribution of allergen positivity on SPT results; and the most common allergens in relation to age groups, living area (urban vs. rural), and sensitization pattern (monosensitization vs. polisensitization) were evaluated. All statistical calculations were performed using SPSS for Windows, version 20.0 (IBM Inc., Chicago, IL, USA). The numeric variables were presented as both median (25th–75th percentile) and mean ± standard deviation. Categorical variables were summarized as counts (percentages).

Results

Study Population

A total of 126 patients with a suspected diagnosis of AR were admitted to our rhinology clinic during the study period. Of these, 104 patients (83%) yielded a positive response to at least 1 allergen on SPT, confirming the definitive diagnosis of AR. Nineteen of the 104 patients were excluded from the study due to living outside of Kocaeli (n=17) and dermagraphism (n=2), leaving 85 patients to participate.

Demographics

The sample consisted of 49 females (57%) and 36 males (42%), with a mean age of 32±12 years and a range of 18–75 years of age. The majority of the AR patients belonged to the 18–35 year age group (67%, n = 57), followed by the 36–50 year age group (25%, n = 21) and the over-50 year age group (8%, n = 7). About 49% came from rural areas, with the remainder from urban areas. Fifty-five percent of patients had perennial AR, while 45% had seasonal AR. The demographic features of the patients are shown in Table 1.

Table 1. Main demographic characteristics of patients

Characterictics	Number of Patients (%)
Gender	
Female	49 (58)
Male	36 (42)
Age (Mean ± SD) *(years)*	32 ± 12
Age groups *(years)*	
18–35	57 (67)
36–50	21 (25)
> 50	7 (8)
Symptom duration of allergic rhinitis	
Perennial	47 (55)
Seasonal	38 (45)
Residence	
Urban	43 (51)
Rural	42 (49)

Prevalence of Sensitization to Common Allergens

House dust mite (HDM) was the most frequent allergen (57.6%) among all AR patients, followed by tree pollen (40.0%), grass pollen (36.5%), weed pollen (32.9%), cockroach (18.8%), animal dander (14.1%), and mold (11.8%). Table 2 and Figure 1 represent the frequency of sensitization to all tested allergens. Regarding the age groups, the most common sensitization was observed to HDM in the 18–35 age group (63.2%), while sensitization to tree pollen was the most prevalent in the remaining older age groups (52.4% and 57.1%). HDM was the leading allergen in both patients living in urban and rural areas, with rates of 65.1% and 50.0%, respectively. Figure 2 represents the frequency of sensitization to all tested allergens according to the geographic area. HDM was the most frequent perennial allergen (70.2%), while tree and grass pollens were the most frequent seasonal allergens in equal proportions (50.0%).

Sensitization Pattern

Regarding the frequency of monosensitization and polysensitization among the study population, 57.6% of the patients were polysensitized. Polysensitization was significantly more frequent in males (69.4%) compared to females (53.0%). The most common three allergens in polysensitized patients were tree pollen (61.2%), grass pollen (57.1%), and HDM (55.1%), respectively. Among the patients who were monosensitized, the top allergen sensitivity was HDM (61.1%). Patients who were monosensitized showed sensitivity to allergens from each allergen group. Regarding the prevalence of polysensitization according to the age groups, the polysensitization rates were 54.4% in the 18–35 age group, 61.9% in the 36–50 age group, and 71.4% in the over-50 age group.

Table 2. Frequency of allergen sensitivity among patients with allergic rhinitis

Allergen group	Percentage (number of patients)
Mites *(Mixture: Dermatophagoides farinae, Dermatophagoides pteronyssinus)*	57.6% (49)
Trees *(Mixture: Alder, White Ash, Black Birch, American Elm, Shagbark Hickory, Maple, White Oak, White Poplar, American Sycamore) and Olive tree*	40.0% (34)
Grasses *(Mixture: Timothy, Orchard, June, Redtop, Meadow Fescue, Perennial Rye)*	36.5% (31)
Weeds *(Lamb's Quarters, English Plantain, Ragweed, Mugwort)*	32.9% (28)
Cockroach	18.8% (16)
Animal danders (*Cat, Dog)*	14.1% (12)
Molds *(Alternaria, Aspergillus, Cladosporium)*	11.8% (10)

Figure 1. Frequency of sensitization to aeroallergens among allergic rhinitis patients

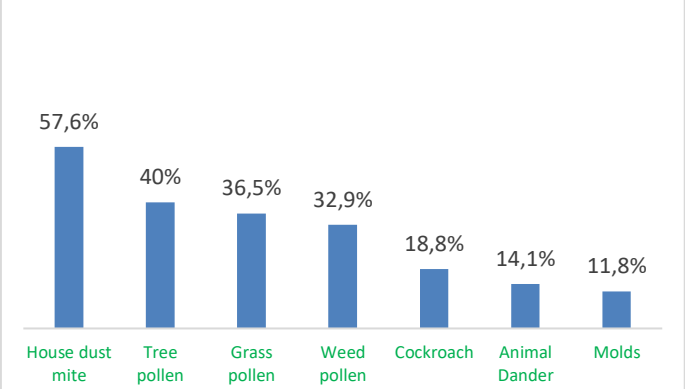
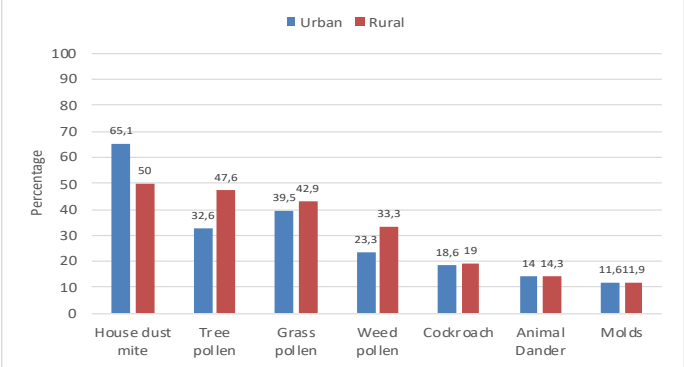


Figure 2. The distribution of aeroallergen sensitization in allergic rhinitis patients according to geographic area



Discussion

The present study was carried out in Kocaeli province to evaluate skin prick test reactivity to aeroallergens in individuals with AR. To our knowledge, this was the first

study to investigate the aeroallergen distribution in adult subjects with AR in Kocaeli province. Our analysis showed that HDM was the most prevalent allergen, being detected in more than half of the patients with AR, followed by tree, grass, and weed pollen. Cockroach, animal dander (cat, dog), and molds (alternaria, aspergillus) were the least common allergens. Considering geographic locations, HDM was the most common allergen in both urban and rural areas, followed by grass and tree pollen in urban areas and grass and tree pollen in rural areas. When sensitization across age groups was evaluated, HDM sensitivity was most common in the youngest age group, while tree pollen sensitization was more common in the older age groups. Most AR patients in our study were sensitized to more than one allergen. When the sensitization pattern was evaluated across age groups, it was found that the number of allergic sensitizations increased with age.

Bousquet et al.[9] reported sensitization to pollen and mites to be the major allergens associated with allergic rhinitis. In line with the findings of the previous study, HDM was the leading allergen in our cohort, followed by pollens. HDM was reported as among the top sensitizing allergens in various geographical regions with humid climates because the survival of mites depends on ambient humidity.[10,11] Kocaeli province is located in the Marmara Region, which is a geographical region of northwestern Turkey. It has a humid subtropical climate that is hot in the winter and summer and rainy all year. According to Turkish State Meteorological Service data from 1929 to 2021, the average temperature is 14.9 °C (highest mean temperature: 19.8 °C; lowest mean temperature: 10.9 °C). The average monthly total rainfall amount was 816.5 mm and the annual average humidity was about 72%.[12] Given the considerable humidity of Kocaeli province, the high prevalence of HDM sensitization in patients with AR was not a surprising finding. Although there is great variability in allergen prevalences among AR patients in various geographical areas of Turkey, in accordance with this study, HDM sensitization was demonstrated to comprise the highest rate, particularly in cities located in northern Turkey, such as Düzce[13,14], Giresun[15], Samsun[16], and Rize[17]. However, one study from İstanbul[18], which is the adjacent city to Kocaeli, found that pollens were the most common allergens. Tree pollen was the second most common allergen in our study, followed by grass and weed pollen. The considerable common prevelance of pollen sensitization was also another expected finding due to the constant high humidity and high rainfall amount in Kocaeli, which creates ideal conditions for the growth of a wide variety of plant species. However, we noticed that the high prevelance of tree pollen sensitization was due to abundant sensitization to olive tree (Olea europaea) pollen with a prevelance of 35% rather than sensitivity to a mixture of 9 tree pollens, which had a prevelance rate of 5%. Olive pollen is regarded as one of the most significant causes of respiratory allergic diseases in the Mediterranean countries, including Spain, Italy, Greece, and Turkey.[19] Cockroaches, animal dander (cat, dog), and molds (alternaria, aspergillus) were revealed to be rare causes of AR in Kocaeli, each affecting less than one-fifth of patients. It is worth noting that none of the subjects in our study were sensitized to Cladosporium herbarum or Mugwort in our SPT panel. It is unlikely that these allergens play a significant role in AR in this area. Therefore, it would seem rational not to include these allergen extracts in the test panel to diagnose AR in Kocaeli province. In terms of geographical areas, there was no discernible difference in the distribution of aeroallergen sensitization between patients living in rural and urban areas across Kocaeli province.

Polysensitization and monosensitization are two phenotypes of IgE-related disease, and polysensitization is associated with an earlier onset of allergy and more severe symptoms when compared to monosensitization.[1] Polysensitization is common in allergy patients, but the prevalence varies by demographic and area. In this study, polysensitization was found to be more prevalent than monosensitization among the AR patients in Kocaeli. The leading allergens in polisensitized patients were tree pollen, grass pollen, and HDM, respectively. Because polysensitization has clinical implications for treatment options such as allergen avoidance and selecting clinically relevant allergen(s) for AIT[8], the SPT panel must include a sufficient number of appropriate allergens belonging to these groups. In monosensitized subjects, HDM was the single most frequent allergen, although monosensitization to every kind of allergen group was detected. This study also revealed that the incidence of polisensitization rises as the age group progresses, suggesting the ongoing development of new sensitizations in adult atopic individuals over time.

The strengths of the present study are: (1) the inclusion of patients with a specific allergic disease and (2) the use of a SPT panel that involves a considerable number of allergens. This study's limitations are that it is a single-center study involving a small number of subjects. Therefore, a multi-center study involving a larger representative sample in the Kocaeli region should be encouraged in the near future. Despite these limitations, however, we believe that our data will provide valuable information to allergists in our region as they establish efficient treatment strategies and construct more specific allergen test panels. In addition, our data can contribute to regional and global etiological research on AR.

Conclusion

The most common allergens in patients with allergic rhinitis in Kocaeli province were house dust mites, tree pollen, and grass pollen, respectively. This data helps to build the chart depicting allergen distribution in the Kocaeli region, which will help to improve the management strategies of patients with allergic rhinitis.

Acknowledgement

I am grateful to Assistant Professor Sibel Balcı for assisting me in the statistical analysis.

Conflict of Interest

The author has no financial relationships or conflicts of interest to disclose.

Compliance with Ethical Statement

Ethics Committee approval for this research was obtained from the Clinical Research Ethics Committee University of Kocaeli (dated September 15, 2022. No: 2022/236).

Financial Support

The author received no financial support for the research and/or publication of this article.

Author Contributions

AY designed the study, collected all of the clinical data, and prepared the manuscript.

References

1. Bousquet J, Anto JM, Bachert C, et al. Allergic rhinitis. *Nat Rev Dis Primers*. 2020;6(1):95. doi:10.1038/s41572-020-00227-0
2. Bousquet J, Khaltaev N, Cruz AA, et al. Allergic Rhinitis and its Impact on Asthma (ARIA) 2008 update (in collaboration with the World Health Organization, GA(2)LEN and AllerGen). *Allergy*. 2008;63 Suppl 86:8-160. doi:10.1111/j.1398-9995.2007.01620.x
3. Cingi C, Topuz B, Songu M, et al. Prevalence of allergic rhinitis among the adult population in Turkey. *Acta Otolaryngol*. 2010;130(5):600-606. doi:10.3109/00016480903311880
4. Dykewicz MS, Fineman S. Executive Summary of Joint Task Force Practice Parameters on Diagnosis and Management of Rhinitis. *Ann Allergy Asthma Immunol*. 1998;81(5 Pt 2):463-468. doi:10.1016/S1081-1206(10)63152-3
5. Gordon BR. Allergy skin tests and immunotherapy: comparison of methods in common use [published correction appears in Ear Nose Throat J 1990 May;69(5):361]. *Ear Nose Throat J*. 1990;69(1):47-62.
6. Bousquet PJ, Chinn S, Janson C, et al. Geographical variation in the prevalence of positive skin tests to environmental aeroallergens in the European Community Respiratory Health Survey I. *Allergy*. 2007;62(3):301-309. doi:10.1111/j.1398-9995.2006.01293.x
7. "Güncel Adrese Dayalı Nüfus Değerleri". Available online at https://biruni.tuik.gov.tr/medas/?kn=95&locale=tr. Archived from the original on December 31, 2021. Accessed September 12, 2022.
8. Migueres M, Dávila I, Frati F, et al. Types of sensitization to aeroallergens: definitions, prevalences and impact on the diagnosis and treatment of allergic respiratory disease. *Clin Transl Allergy*. 2014;4:16. doi:10.1186/2045-7022-4-16
9. Bousquet J, Annesi-Maesano I, Carat F, et al. Characteristics of intermittent and persistent allergic rhinitis: DREAMS study group. *Clin Exp Allergy*. 2005;35(6):728-732. doi:10.1111/j.1365-2222.2005.02274.x
10. Mahesh PA, Kummeling I, Amrutha DH, Vedanthan PK. Effect of area of residence on patterns of aeroallergen sensitization in atopic patients. *Am J Rhinol Allergy*. 2010;24(5):e98-e103. doi:10.2500/ajra.2010.24.3529
11. Valenzano C, Cadario G, Cerè G, Grimaldi I, Oliaro A. Indagine statistica effettuata in Piemonte su 1100 casi di rinite da ipersensibilità ad allergeni inalanti [Statistical study done in Piedmont on 1100 cases of rhinitis caused by hypersensitivity to inhaled allergens]. *Minerva Med*. 1986;77(3-4):119-122.
12. Turkish State Meteorological Service. Statistical data for cities. Available online at https://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?k=A&m=KOCAELI; accessed september 12, 2022.
13. Konuk S. Skin prick test in allergic rhinitis in Duzce province of Turkey. *Biomedical Research-Tokyo* 2017; (28):6872-6875.
14. Öztürk Ö, Tokmak A, Güçlü E, Yıldızbaş Ş, Gültekin E. Düzce'de Allerjik Rinitli Hastalarda Prick Testi Sonuçları. *Duzce Medical Journal*. 2005; 7(1): 11-14.
15. Oğuz İD, Hızlı Ö, Akşan B. Giresun Bölgesi Deri Prick Testi Sonuçlarının Kapsamlı Analizi. *Konuralp Medical Journal*. 2019; 11(2): 295-301.
16. İğde M, İğde F, Sancak R, et al. Orta Karadeniz Bölgesindeki çocuklarda allerji deri testi sonuçları. *Turkiye Klinikleri Journal of Pediatrics*. 2009;18(2):82-90.
17. Coskun ZO, Erdivanlı OC, Kazıkdas KÇ, et al. High sensitization to house-dust mites in patients with allergic rhinitis in the eastern Black Sea region of Turkey: A retrospective study. *Am J Rhinol Allergy*. 2016;30(5):351-355. doi:10.2500/ajra.2016.30.4353
18. Aydin S, Hardal U, Atli H. An analysis of skin prick test reactions in allergic rhinitis patients in Istanbul, Turkey. *Asian Pac J Allergy Immunol*. 2009;27(1):19-25.
19. D'Amato G, Cecchi L, Bonini S, et al. Allergenic pollen and pollen allergy in Europe. *Allergy*. 2007;62(9):976-990. doi:10.1111/j.1398-9995.2007.01393.x