

Is it important to perform pollen skin prick tests in the season?

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Background: Seasonal exposure to pollens causes the characteristic symptoms of respiratory allergy as well as an increase in specific IgE levels and inflammatory mediator release. However, little is known about the effect of natural allergen exposure on the skin test reactivity of patients with seasonal allergy.

Objective: The aim of this study was to investigate the monthly variation in skin test reactions with pollen allergens during pollen season and its relation to pollen counts.

Methods: Fifteen subjects with seasonal allergic rhinitis and/or asthma (4 male, 11 female) between the ages of 13 and 52 (mean 33.9 ± 2.9) who lived in Ankara, Turkey were selected for this study. Patients were monitored from the beginning of March to the end of September 1997, and skin prick tests were performed using 5 grass, 12 tree, and 5 weed pollen allergen extracts every month. Atmospheric pollen grains were counted in the Ankara area between January and December, 1997.

Results: There were small but statistically significant increases in tree pollen-induced wheal sizes in May when compared with other months ($P < 0.05$). Skin test reactivity was correlated with tree pollen counts ($r = 0.978$, $P < 0.05$). There was not a significant difference in skin test reactivity to grass and weed pollens between months.

Conclusions: Although skin test reactivity may be slightly greater to tree pollen during the tree pollen season, the timing of skin testing is not a critical determinant in patients with pollen allergy.

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INTRODUCTION

Airborne pollens are the most important allergens that cause sensitization in allergic rhinoconjunctivitis and asthma. There is evidence that the prevalence of allergic diseases induced by pollen is increasing.¹ Seasonal changes of symptoms and inflammatory mediator release are suggested to be closely related to allergenic stimulation during natural pollen exposure.² Serum IgE levels and bronchial responsiveness were also reported to increase in pollen season in these pa-

tients.^{3,4} Further, elevated levels of soluble intercellular adhesion molecule-1 and interleukin-2 receptor were present in patients with allergic rhinitis during the seasonal aggravation.^{5,6} In subjects with respiratory allergy to pollen, it is common to correlate the onset, duration, and intensity of clinical symptoms with the count of atmospheric allergenic pollen grains. However, it is not clear whether the natural pollen load has an effect on skin test reactivity during the pollen season. The aim of our study was to investigate monthly variation of skin test sensitivity to pollens in relation to the counts of the same pollen species in patients with seasonal allergy.

MATERIALS AND METHODS

Fifteen subjects (4 male, 11 female) between the ages of 13 and 52 (mean

33.87 ± 2.87) living in the Ankara area were recruited for the study. These subjects had all suffered from seasonal rhinoconjunctival and/or asthmatic complaints that were related to natural pollen exposure for at least the previous 3 years.^{7,8} Informed consent was obtained from all subjects. Subjects were excluded from the study if they had received or were undergoing immunotherapy and/or using systemic corticosteroid treatment. Patients were not allowed to use medicines with antihistaminic effect for at least 1 week before each test, and to travel from the area for at least 2 weeks before each skin testing session in an attempt to eliminate regional variations in allergen exposure. We used the prick method of skin testing in all patients throughout the study. Initially, skin prick tests (SPTs) were performed with a standardized panel including mites (*Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*), 5 grass (*Dactylis glomerata*, *Lolium perenne*, *Phleum pratense*, *Poa pratensis*, *Anthoxanthum odoratum*), 13 tree (*Alnus glutinosa*, *Quercus robur*, *Corylus avellana*, *Betula alba*, *Populus alba*, *Salix caprea*, *Olea europea*, *Acer pseudoplatanus*, *Ulmus campestris*, *Fagus sylvatica*, *Sambucus nigra*, *Tilia platyphyllos*, *Carpinus betulus*), 5 weed (*Artemisia vulgaris*, *Chenopodium album*, *Rumex acetosa*, *Parietaria officinalis*, *Plantago lanceolata*) pollens, cat, dog, and mold (*Alternaria*, *Cladosporium*, *Aspergillus*, *Candida*, *Penicillium*) antigens (Stallergènes SA, Antony, France). All SPTs were performed using a 1-mm tip disposable prick lancets (Allergologisk Laboratorium, Copenhagen, Denmark). Skin tests were placed on the back of patients and the drops were dispensed 2 cm apart to avoid false-positive reactions. Skin test reactions were read 15 minutes after the

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test allergen application. The size of each reaction was measured with a transparent millimeter ruler. Wheal and flare measurements were taken in two perpendicular directions. Both the largest and smallest diameters were recorded, summed, and divided by 2. A mean wheal diameter of 3 mm or greater than the control solution was considered positive. Negative diluent and positive histamine skin tests were recorded as well. Histamine dihydrochloride (10 mg/mL) and glycerol diluent were used as positive and negative controls, respectively. To prevent interobserver variability, one doctor, who had special training in allergy, performed all SPTs.

Specific IgE levels to mixed grass (gx1), tree (tx5,tx7), and weed (wx1) pollen allergens were measured by the Pharmacia CAP system (Pharmacia-Upjohn AB, Uppsala, Sweden) at the beginning of the study. We analyzed RAST levels only before the study to confirm the pollen allergy determined by the positive skin prick tests, and included only those patients having high positive specific IgE levels. During the followup period, pollen allergic patients underwent monthly (from March to September, seven times) skin testing by the prick method using 5 grass, 13 tree, and 5 weed pollen allergen extracts all supplied from Stallerg nes SA, Antony, France.

Airborne pollen grains were counted in the Ankara atmosphere from January to December in 1997 and a pollen calendar was represented (Fig 1). The Hirst-Burkard (Burkard Manufacturing, Rickmansworth, Hertfordshire, UK) 7-day recording volumetric spore trap was used for sampling. The pollen was sucked at an air flow rate of 10 L per minute onto tapes which were coated with a thin film of petroleum jelly (Vaseline, Chesebrough-Pond, Jefferson City, MO)-paraffin wax in toluene. The tape was then mounted in glycerin jelly. The 12 transverse stripes were counted on each slide, at a magnification of 400 . Counts were made at 2-hour intervals and total daily counts were converted to numbers per cubic meter of air.⁹ The number of pollen was counted daily by the Pa-

lynological Laboratory in the Department of Biology of Ankara University.

Statistical Analysis

Two-factor repeated measure ANOVA with one factor within was used for analysis of monthly skin test reactivities to pollens. Analyses of differences in histamine skin test reactivities between months were performed with ANOVA test. A Duncan test was used for the comparison of different groups. A correlation coefficient was calcu-

lated for the relationship between monthly skin test reactivities to pollens and pollen counts. Mean values ($\pm$ SEM) were calculated for the parameters at each skin testing session and the changes were examined in relation to pollen counts. A *P* value < 0.05 was considered statistically significant.

RESULTS

Monthly distribution of total tree, grass and weed pollen counts are given in



Figure 1. Ankara pollen calendar (1997 to 1998).

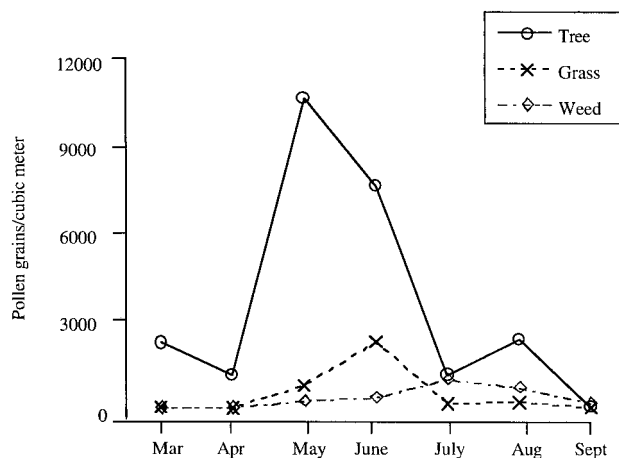


Figure 2. Monthly distribution of total pollen counts.

Fig 2. Mean skin test wheal diameters to tree, grass, weed pollens, and histamine according to months are presented in Figure 3 and all data points are expressed as mean $\pm$ SEM. Although skin test reactivity to histamine increased within May and June, there was no significant difference between months (mean $\pm$ SEM histamine wheal diameters were 6.20 ± 0.60 mm in March; 7.03 ± 0.46 mm in April; 7.47 ± 0.432 mm in May; 7.50 ± 0.57 mm in June; 6.71 ± 0.42 mm in July; 7.10 ± 0.63 mm in August; 6.77 ± 0.62 mm in September, $P > 0.05$). Additionally, there was no significant difference in skin test sensitivity to grass and weed pollens between months (mean $\pm$ SEM values for grass were 13.9 ± 2.22 mm in March; 10.9 ± 2.21 mm in April; 13.4 ± 2.66 mm in May; 11.8 ± 1.92 mm in June; 12.3 ± 1.81 mm in July; 11.9 ± 2.77 mm in August; 9.3 ± 2.18 mm in September; and for weed pollens were 5.45 ± 0.61 mm in March; 5.54 ± 0.95 mm in April; 5.87 ± 0.90 mm in May; 5.38 ± 0.90 mm in June; 6.20 ± 1.26 mm in July; 5.50 ± 0.97 mm in August; 6.74 ± 1.77 mm in September). However, the mean tree pollen-induced wheal size was significantly greater in May than in March and June (mean wheal sizes were 5.82 ± 1.02 mm in May; 4.23 ± 0.88 mm in March; and 4.72 ± 0.94 mm in June, $P < 0.05$). Skin test reactivity to tree

pollens significantly increased in the same month as the tree pollen count peak. In addition, tree pollen counts correlated well with skin test sensitivity ($r = 0.978$, $P < 0.05$). The association between tree pollen counts and mean skin test reactivities (4.23 ± 0.88 mm in March; 4.77 ± 0.87 mm in April; 5.82 ± 1.02 mm in May; 4.72 ± 0.94 mm in June; 5.27 ± 1.37 mm in July; 5.33 ± 1.4 mm in August;

5.42 ± 2.03 mm in September) is shown in Fig 4. Although grass pollen counts peaked in May and June in association with an increase in grass-induced wheal sizes in these months (13.4 ± 2.66 mm and 11.8 ± 1.92 mm, respectively), this did not reach statistical significance.

DISCUSSION

Immediate skin testing remains the diagnostic method of choice in the evaluation of IgE-mediated sensitivity. The reproducibility of skin test results has been confirmed in several studies. Also, skin prick testing has been shown to correlate with both symptoms and RAST.¹⁰ Many studies have shown a rise in serum and nasal secretion specific IgE levels in grass sensitive patients during the pollination season.¹¹⁻¹³ Further, Studnicka et al¹⁴ found increased bronchial and skin test responsiveness in spring among children allergic to grass pollen and paralleled by increased ambient aeroallergen exposure.

Seasonal variation in skin test reactivity was addressed previously in a limited number of studies.¹⁵⁻¹⁹ Skoner

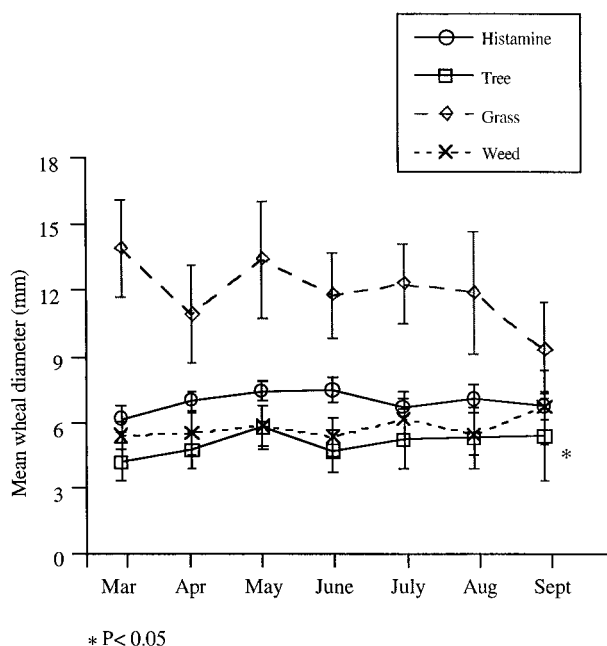


Figure 3. Monthly variation of grass, tree, and weed pollen and histamine skin prick test sizes. *, $P < 0.05$, March versus September skin test reactions to tree pollens.

et al¹⁶ reported seasonal increases in grass- and histamine-induced wheal sizes accompanying pollen counts during seasonal exposure. In contrast, Casanovas et al¹⁷ demonstrated a discrepancy between the results of SPTs (low cutaneous reactivity associated with high allergenic environmental load) and the levels of specific IgE to the olive pollen, suggesting that the capacity to release mediators may be decreased, at least in the skin. Also, Zwick et al¹⁸ found that high grass pollen load resulted in a significantly higher frequency of increased specific IgE production than SPT reactivity or manifest allergies. In a study by Oppenheimer et al,¹⁹ the greatest skin test reactivity to histamine, ragweed, and trees was observed in October and was explained by a priming effect on the skin. To our knowledge, there have been no detailed long-term studies investigating the relation between month-to-month or seasonal changes in skin test reactivity and natural atmospheric pollen load. In our study, we investigated whether monthly skin test reactivity to pollens is correlated with the counts of the same pollen species during the season. We found that although skin test reactivity to grass pollens increased in May in association with a peak in the grass pollen counts of May and June, the only significant difference in wheal sizes between months was observed with tree pollens. The changes in grass-induced wheal sizes between March and April paralleled the changes in tree pollen counts in the same months. The earlier increase in skin test reactivity to grass pollens might be caused by the priming effect of tree pollens. The tree pollen-induced wheal sizes were significantly different between March and September. The change in tree pollen counts was greatest and also correlated with the largest variability of skin test size. An important point was that, despite a rapid decline in pollen counts after a peak in May, high wheal diameters to tree pollens continued in the following months. This may be explained by the priming effect of tree pollens on the skin secondary to seasonal pollen ex-

posure and may be a dose-dependent relationship.

However, it has been previously demonstrated that the increase of immediate specific bronchial sensitivity to allergen is associated with the delayed increase in specific IgE antibodies to birch pollen after season.²⁰ Boulet et al²¹ also reported an increase in bronchial responsiveness after natural antigenic exposure in nonasthmatic subjects with seasonal rhinitis. In this study, it was found that greatest airway hyperreactivity developed slightly after the highest increase in pollen counts, suggesting a delayed effect of antigens on airway responsiveness. The mucous membranes of the eyes and upper and lower airways of allergic subjects are regularly exposed to pollen grains at a given time. Also, the skin having a greater surface area is directly in contact with aeroallergens such as pollens. Therefore, sensitization through the skin may develop more easily than the other exposure routes. As a result, we suggest that the end organ of the skin behaves more like a mucous membrane which has been initially primed by a natural pollen load during the season.

Although different factors may also influence the level of exposure of each subject to pollens, such as the time spent outdoors and local difference in

pollen counts, changes in the skin test reactivity during the natural allergen exposure may possibly require a threshold exposure to occur.

Another aim of our study was to evaluate the clinical relevance of skin test timing in pollen allergic patients. We observed that natural antigenic exposure to pollens has an effect on skin test responsiveness in sensitized patients. Also, it should be noted that several of the previous seasonal skin test studies have relied upon more sensitive skin test techniques, such as end-point titration or skin tests in duplicate. However, this study demonstrates that, clinically, we can rely upon skin tests both in and out of season.

In summary, our data indicate a relation between natural pollen exposure and skin test reactivity in seasonal allergic patients. But nevertheless, it does not seem important to perform SPTs exclusively in the pollen season to identify pollen sensitivity.

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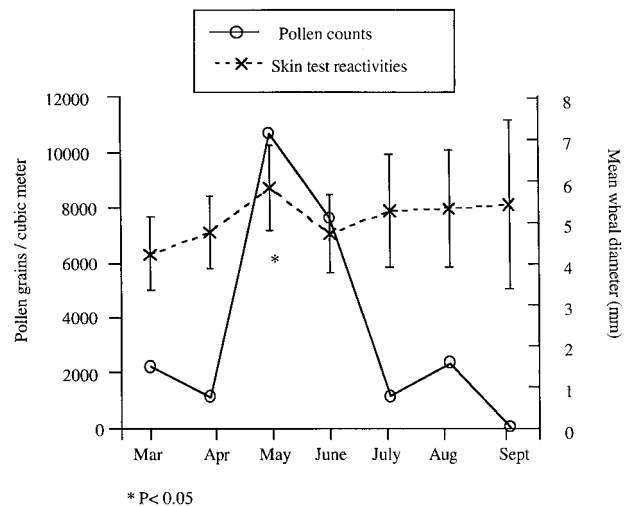


Figure 4. Association between total tree pollen counts and mean skin test reactivities. *, $r = 0.978$, $P < 0.05$.

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