# The Prevalence and Patterns of Allergic Sensitization in Isparta, Turkey

## Isparta'da Görülen Alerjik Duyarlılaşma Paternleri ve Sıklığı

Allergic Sensitization Patterns in Isparta

Ayşe Aynali[1], Buket Cicioğlu Arıdoğan[1], Ayşe Gül Ergün[2], Emel Sesli Çetin[1], Selçuk Kaya[3], Süleyman Akif Çarsancaklı[1]
[1]Medical Microbiology Department, Suleyman Demirel Univresity, Faculty of Medicine, Isparta,
[2]Medical Microbiology Laboratory, Konya Numune Hospital, Konya,
[3]Medical Microbiology Laboratory, İzmir Katip Celebi University, Ataturk Training and Research Hospital, İzmir, Turkey

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**Özet**

Amaç: Bu çalışma, Isparta'da görülen alerjik duyarlılaşma paternleri ve sıklığının belirlenmesi amacıyla planlanmıştır. Gereç ve Yöntem: 266'sı çocuk, 213'ü kadın, 119'u erkek toplam 598 hastanın serum spesifik IgE düzeyleri fluoroenzymeimmunoassay metod (UniCAP, Pharmacia and Upjohn Diagnostics) ile üretici firmanın önerileri doğrultusunda ölçülmüş ve değerlendirilmiştir. Bulgular: Çocuklarda alerjen duyarlılığı % 26.3, yetişkinlerde % 27.1 oranındadır. Cinsiyete göre sonuçlar irdelendiğinde ise erkek çocuklarda % 32.9, kız çocuklarda % 16.7, yetişkin erkeklerde % 40.3, yetişkin kadınlarda % 19.7 oranında alerjen duyarlılığı olduğu tespit edilmiştir. Herhangi bir alerjene duyarlılık saptanan çocuk ve yetişkin yaş grupları arasında yapılan istatistiksel analizlerde anlamlı farklılık saptanmamıştır (p> 0.05). Cinsiyet yönünden karşılaştırıldıklarında ise erkeklerde kız çocuklarına kıyasla ve yetişkin erkeklerde kadınlara kıyasla daha yüksek oranda alerjen duyarlılığı tespit edilmiş olup bu fark istatistiksel olarak anlamlı bulunmuştur (p< 0.05). Tartışma: Çalışmamızda alerjen olarak en sık Ambrosia trifida (31.6 %), honey bee (31.2 %), elm (27.6 %), nuts (18.5 %), cows epithelium (17.4 %), Akarus siro (11.5 %), pen G (4.2 %) tespit edilmiştir. Yapılan analize göre bölgemizde en sık çimen ve ot polenleri, ağaç polenleri ve besinlere karşı duyarlılık tespit edilmiş ve özellikle erkeklerde alerjik duyarlılaşmanın daha sık olduğu sonucuna varılmıştır.

**Anahtar Kelimeler**

Alerji; Alerjik Duyarlılaşma; Spesifik IgE; Prevalans

**Abstract**

Aim: The aim of this study was to investigate the prevalence and pattern of allergic sensitization in Isparta. Material and Method: Of the patients, 266 were children, 213 were women, and 119 were men. Serum specific IgE levels were analyzed by fluoroenzymeimmunoassay method (UniCAP, Pharmacia and Upjohn Diagnostics AB, Uppsala, Sweden). Results: Serum specific IgE levels were positive in 27.1% of the adults and in 26.3% of the children. Hypersensitivity to allergens was determined in 32.9% of boys, in 16.7% of girls, in 40.3% of men, and in 19.7% of women. There was no difference in allergy prevalence in terms of age (p> 0.05). However, the prevalence of allergic sensitization in males was found significantly higher than in the females (p< 0.05). The most frequently encountered allergens were as follows: Ambrosia trifida(31.6 %), honey bee (31.2 %), elm (27.6 %), nuts (18.5 %), cow epithelium (17.4%), Acarus siro (11.5 %), and penicillin G (4.2 %). Discussion: It was determined that the rates of sensitization against grass and weed pollens, tree pollens, and foods were high in Isparta and they exhibited an increased tendency in males.

**Keywords**

Allergy; Allergic Sensitization; Specific IgE; Prevalence

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Corresponding Author: Ayşe Aynali, Medical Microbiology Department, Suleyman Demirel University, Faculty of Medicine, 32260, Isparta, Turkey.
T.: +90 2462119453 F.: +90 2462371762 E-Mail: draysenali@yahoo.com

## Introduction

The prevalence and diversity of allergic diseases have a tendency to increase in both our country and the world. The complicated interaction between nonspecific factors such as infections, cigarette smoking, air pollution, exposure to various allergens, the introduction of new environmental factors, shifting from traditional lifestyles, and genetic factors lead to this condition. These factors threaten both children and adults [1,2,3].

The common clinical circumstances in allergy are allergic rhinitis, asthma, anaphylaxis, urticaria, and eczema. In the management of allergic diseases, principally the allergens causing the allergy should be detected and avoided [4]. Furthermore, since allergic sensitization is an important factor for the development of allergic disease, the IgE-mediated sensitization patterns and prevalences of the societies should be determined [5]. In vivo skin tests and in vitro serological analyses for evaluation of sIgEs are applied in order to detect allergic sensitization. Clinical anamnesis and physical examination also play roles in diagnosis [6].

In vitro skin tests cannot be performed on some patients due to the risk of systemic reactions, false negative and positive results, difficulties in application to small children, interaction with ongoing treatments, and instability of the allergens in solutions [7]. In these conditions, in vivo tests are preferred. It is stated that the probability of the disease being related to IgE is below 5% in case of a negative specific IgE test result [7,8].

Recently concerns about epidemiological evaluations of the allergic diseases have been increaseing worldwide because the distinctness of prevalence based on various factors are observed not only within countries but also within different regions of a country [1]. Accordingly, in the present study, we aimed to investigate the prevalence and patterns of allergic sensitization in Turkey and to contribute to the determination of the allergy profile of Turkey.

## Material and Method

Data of 598 patients from various clinical departments of Süleyman Demirel University Faculty of Medicine for whom allergy tests were ordered to consider an allergic etiology were analyzed retrospectively. Serum specific IgE (sIgE) levels were analyzed by the fluoroenzymeimmunoassay method according to the advice of the manufacturer (UniCAP, Pharmacia and Upjohn Diagnostics). Values between 0.35- 100 kU/L were taken into consideration and values greater than 0.35 kU/L were accepted as positive. Serum sIgE parameters include grass and weed pollens (ambrosia elatior, ambrosia trifida, anthoxantum odorat, artemisia vulgaris, cynadon dactylon, holcus lanatus, lolium perene, phleum pratense, phragmites communis, plantago lanceolata, poa pratensis, secale cereale, sorghum halpense, mixed grass (GX1, GX2) and mixed wild weed pollens (WX1)), tree pollens (acacia, pine, white pine, sycamore, mulberry, birch, elm, populusu, oak, cedarwood, cypress, willow, walnut tree and mixed tree pollens (TX4)), foods (wheat, walnut, strawberry, tomato, hazelnut, gluten, cow milk, cacao, melon, goat milk, cultivated mushroom, banana, orange, total egg, egg white, egg yolk), mixed fruit (FX15), mixed cereal (FX20), mixed foods (FX5, FX8, FX26), animal epithelium and hairs (cow, canary, goat, cat, sheep, dog, chicken), mixed animal epithelium and hairs (EX1), mites (Akarus siro, Dermatophagoides farinae, Dermatophagoides pteronyssinus, Glycyphagus domesticus) and mixed house dust mites (HX2), fungi (Alterneria alternata, Aspergillus fumigatus, Candida albicans, Cladosporium herba, Mukor, Penicillium notatum, Ptyrosporum orbi and mixed fungi (MX1)), bacteria (Staphylococcus enterotoksin A and B), bee venoms (Honey bee, Yellow jacket, Yellow hornet), parasites (Ascaris, Echinococcus), and drugs (Ampicillioly, Amoxicilloly, Pen G, Pen V).

Approval was received for this study from the ethics committee of the Suleyman Demirel University, Medical Faculty (reference number: 72867572_050_2373).

Statistical analyses were performed using the SPSS 15.0 program. The data's compliance with normal distribution was tested by One Sample Kolmogorov Simirnov Test. The Mann-Whitney U test was used for nonparametric variables and $p< 0.05$ was accepted as statistically significant.

## Results

Of the 598 patients whose serum sIgE test results were evaluated, 213 (35.6%) were adult females with a mean age of 43.5±13.8 (17–85); 119 (19.9 %) were adult males with a mean age of 45.1±15 (17–80); and 158 (26.4 %) were boys and 108 (18.1%) were girls, with a total of 266 (44.5 %) children whose mean age was 7.3±3.7 (1–16). In the present study,

26.8 % (160/598) of the individuals tested as positive for at least one allergen while 73.2% (438/598) of the individuals were accepted as negative for any allergen. Of the 160 patients with positive test results, 68 had sensitivity to one allergen while 92 had sensitivity to more than one allergen. Of the 160 patients with sensitivity, 70 were children (52 boys and 18 girls) with a mean age of 8.2±3.8 (2–16). Forty-eight of these 160 patients were adult males with a mean age of 45±15 (17–76) and 42 were adult females with a mean age of 40.3±12.1(18–85). The prevalence of sensitivity to allergens was 26.3% in children while it was 27.1% in adults. When the results were examined in terms of gender, 32.9% of boys,

16.7% of girls, 40.3% of adult males and 19.7% of adult females had sensitivity to allergens. In the present study, there was no difference in allergy prevalence in terms of age ($p> 0.05$). No statistically significant difference was found between the adult and child groups for allergen sensitivity ($p> 0.05$). When a comparison in terms of gender was performed, a higher prevalence of sensitization was observed among male adults and boys and the difference was statistically significant ($p< 0.05$). The sensitivity prevalences according to gender and age are presented in table 1.

The sIgE mixed tests performed in our study, the allergen sensitivity, and the prevalence of allergy in our region according to sIgE mixed test results are presented in table 2.

According to single sIgE test results, the most common allergen among grass and weed pollens was ambrosia trifida (31.6 %), followed by sorghum halpense (17.8%); the most common allergen among tree pollens was elm (27.6 %) followed by cedar (26.7 %); the most common allergen among food was hazelnut (18.5 %) followed by walnut, strawberry, and melon (16.7 %); the most common allergen among animal epithelium and hairs was cow epithelium (17.4 %) followed by cat epithelium and hair (16.7 %); the most common allergen among mites was

Table 1. The prevalance of allergic sensitization according to age and gender

| | Girl n (%) | Boy n (%) | Female n (%) | Male n (%) | Total |
|---|---|---|---|---|---|
| Total number (%) | 108 (18.1 %) | 158 (26.4 %) | 213 (35.6 %) | 119 (19.9 %) | 598 |
| Allergy (+) | 18 (11.25 %) | 52 (32.5 %) | 42 (26.25 %) | 48 (30 %) | 160 |
| Allergy(-) | 90 (20.5 %) | 106 (24.25%) | 171 (39%) | 71 (16.25 %) | 438 |
| Allergy (+) among the group | 18/108 (16.7 %) | 52/158 (32.9 %) | 42/213 (19.7 %) | 48/119 (40.3 %) | 160 (26.8 %) |

Table 2. The allergen sensitivity and the prevalance of allergy in Isparta/Turkey according to sIgE mixed test results

| Specific IgE (mixed) | Prevalance of allergy (%) | Positivity/number of the individuals tested |
|---|---|---|
| FX 5 | 19 % | 4/21 |
| GX1 | 18.2 % | 12/66 |
| WX1 | 16.9 % | 81/478 |
| FX 20 | 11.7 % | 53/453 |
| TX4 | 11.4 % | 55/480 |
| FX 15 | 10.7 % | 6/56 |
| HX2 | 9.8 % | 7/71 |
| FX 26 | 9.4 % | 38/402 |
| GX2 | 7.7 % | 1/13 |
| EX1 | 6.3 % | 30/477 |
| FX 8 | 5.4 % | 14/260 |
| MX1 | 3.2 % | 15/467 |

FX 5 (egg white, milk, fish, wheat, hazelnut, soya bean), GX1(Dactyirs glomerata, festuca elation, lolium perene, phleum pratense, poa pratensis), WX1(ambrosia elatior, artemisia vulgaris, plancato lanceolata, cheropadium album, salsola kali), FX 20 (wheat, rye, barley, rice), TX4 (quercus alba, ulmus americana, platanus acerifolia, salix caprea, populus deltoides), FX 15 (orange, apple, banana, peach), HX2 (Hollister-stler labs, Dermatophagoides pteronyssinus, Dermatophagoides farinae, Blatella germanica), GX2(cynadon dactylon, lolium perene, phleum pratense, poa pratensis, sorghum halpense, paspalum notatum), EX1 (cat dander, horse dander, cow dander, dog dander), FX 8(hazel nut, brazil nut, orange, apple, cacao), MX1 (Penicillium chrysogenum, Cladosporium herbarum, Aspergillus fumigatus, Alternaria alternata)

Acarus siro (11.5 %) followed by D. farinae (11.1%); the most common allergen among microorganisms, parasites, and bee venoms was honey bee (31.2 %) followed by echinococcus (11.1 %); and the most common drug allergen was pen G (4.2 %). The prevalence of allergy and distribution of allergens according to single sIgE test results in our region are given in table 3.

## Discussion

The risk factors for allergic diseases have not been investigated adequately in the Turkish population and the present research is limited to a few studies focusing on certain occupations.2 Genetic factors are not sufficient to explain the increase in the prevalence of allergic disease both in our country and globally. Today, the most commonly suspected explanation for the increase is rapidly evolving environmental factors [1,9,10]. Although living in rural or urban areas are well known factors, there is not a consensus on this issue [2]. While some studies from Europe report that allergic diseases and asthma are more prevalent in urban areas than in rural areas, some other researchers claim that there is not a certain association [2,11,12]. Since Turkey has varying climate conditions and vegetation in its different geographic regions, it is expected that the type, density, and variability of pollens in the atmosphere exhibit regional differences. Therefore, multicentered studies are required to determine the prevalence of allergic diseases and allergic sensitization in Turkey.

Specific IgE levels increase after exposure to allergens and decrease with distance from allergens [13]. The existence of sIgE proven by either skin prick tests or immunoassays should be substantiated by anamnesis and clinical status [6]. As in our study, screening the cases with probable allergic etiology by sIgE tests provides information about which allergens people are exposed to in a given area.

In our study, the rate of sIgE positivity was 26.3% (70/266) in children and 27.1% (90/332) in adults and there was no statistically significant difference between child and adult groups ($p > 0.05$). The allergen sensitivity rate was 32.9% in boys, 16.7% in girls, 40.3% in adult males, and 19.7% in adult females. There were statistically significant higher rates of allergen sensitivity in boys compared to girls and in adult males compared to adult females ($p < 0.05$). The data we have gained is an indication that allergic etiology should be considered and tested for when encountered in boys or adult male patients in Isparta and its environs. These rates vary according to studies from both our country and abroad. In a study from Mersin, hypersensitivity positivity rate was 47.8% in adult females, 43% in adult males, 74.8% in boys and 39.6% in girls. The sensitivity rates were as follows: 23.6% for mites, 22.4% for weeds, 16.6%, for animal epithelia, 11.6% for mold, 10.1% for trees, 7.9% for food, and 7.6% for wild grass [14]. In a study from Malatya, the positivity rate was 64.3% in adults and 44.2% in children. İn the same study, the sensitivity rate to single allergens was reported to be 17.7- 28.3% in children and 20.1- 42.0% in adults [15].

According to sIgE test results, the most common allergen among grass and weed pollens was ambrosia trifida (31.6%), among tree pollens was elm (27.6 %), among food was hazelnut (18.5%), among animal epithelium and hair was cow epithelium (17.4%), among mites was Acarus siro (11.5%), among microorganisms, parasites, and bee venom was honey bee (31.2%), and among drugs was pen G (4.2%). Testing those parameters for which higher rates of sensitivity have been defined would make diagnoses easier and screenings more effective in the management of patients with suspicion of allergic etiology in our region.

In another study from Isparta, skin prick test results of 554 cases with prediagnosis of allergic rhinitis were examined and a positivity rate of 82% was found. The sensitivity rates to grass-mix, weed-mix, house dust mites, and tree-mix were 70.5%, 45.9%, 35.6%, and 25.1% respectively. The higher rates of allergy positivity in this study may be due to selection of a special patient group [16].

Both in Turkey and in other countries, allergy positivity rates vary by region. In a study from Kayseri, there was positivity of 20.1% in sIgE mixed tests and 34.8% in single sIgE tests. The highest positivity rate was in the child panel and for wild weed; the highest positivity rate in single tests was detected as D. pteronyssinus followed by D. farinae, oat, corn and barley [17]. The frequency of allergic sensitization to food was observed to be between 6.6 % and 23.6 % in a study conducted in different regions of Europe; hazelnut (9.3%), peach (7.9%), and apple (6.5%) were found to be the most common food allergens [18]. In a study from China, while D. pteronyssinus and D. farinae

Table 3. The prevalance of allergy and distribution of allergens according to sIgE (single) test results

| Food | Grass and weed pollens | Tree pollens | Animal epithelium and hairs | Mites | Microorganism/ Parasite/ insects | Drugs |
|---|---|---|---|---|---|---|
| Hazelnut | A. trifida | Elm | Cow epihtelium | Acarus siro | Honey bee | Penicillin G |
| 18.5 % (12/65) | 31.6 % (6/19) | 27.6 % (8/29) | 17.4 % (4/23) | 11.5 % (3/26) | 31.2 % (5/16) | 4.2 % (1/24) |
| Walnut | S. halpense | Sycamore | Cat epithelium and hair | D. farinae | Echinococcus | Ampicillioly |
| 16.7 % (9/54) | 17.8 % (5/28) | 26.7 % (4/15) | 16.7 % (4/24) | 11.1 % (3/27) | 11.1 % (1/9) | 0 % (0/21) |
| Strawberry | P. lanceolata | Poplar | Dog epithelium | D.pteronyssinus | Yellow hornet | Amoxicilloly |
| 16.7 % (1/6) | 15.8 % (3/19) | 26.3 % (5/19) | 12.5 % (2/16) | 10.7 % (3/28) | 7.7 % (1/13) | 0 % (0/20) |
| Melon | P. communis | Cypress | Dog hair | G.domesticus | P. notatum | Penicillin V |
| 16.7 % (9/54) | 15.8 % (3/19) | 25 % (2/8) | 8.7 % (2/23) | 9.5 % (2/21) | 0 % (0/18) | 0 % (0/15) |
| Tomato | P. pratense | Cedar | Goat epithelum | | A. alternata | |
| 15.8 % (10/63) | 15.4 % (4/26) | 22.7 % (5/22) | 6.7 % (1/15) | | 0 % (0/17) | |
| Gluten | A. odorat | Oak | Chicken hair | | C. albicans | |
| 12.3 % (7/57) | 14.3 % (4/28) | 20.7 % (6/29) | 0 % (0/16) | | 0 % (0/15) | |
| Orange | C. dactylon | Birch | Canary hair | | A. fumigatus | |
| 11.7 % (7/60) | 13.8 % (4/29) | 17.4 % (4/23) | 0 % (0/14) | | 0 % (0/15) | |
| Banana | L. perene | White pine | Sheep epithelium | | C. herba. | |
| 10 % (2/20) | 13.3 % (2/15) | 17.4 % (4/23) | 0 % (0/14) | | 0 % (0/15) | |
| Wheat | P. pratensis | Willow | | | Ascaris | |
| 10 % (1/10) | 11.5 % (3/26) | 15.8 % (3/19) | | | 0 % (0/10) | |
| Cakao | A. elatior | Mulberry | | | Staph enterotoksin A | |
| 8.3 % (1/12) | 10 % (1/10) | 13.6 % (3/22) | | | 0 % (0/9) | |
| Goat milk | H. lanatus | Pine | | | P. orbi | |
| 7.7 % (3/39) | 8.3 % (2/24) | 8.3 % (1/12) | | | 0 % (0/9) | |
| Cultivated mushroom | S. cereale | Walnut tree | | | Mucor | |
| 7.7 % (4/52) | 7.4 % (2/27) | 8.3 % (1/12) | | | 0 % (0/9) | |
| Egg yolk | A. vulgaris | Acacia | | | Staph enterotoksin B | |
| 6.7 % (3/45) | 0 % (0/21) | 0 % (0/5) | | | 0 % (0/8) | |
| Egg white | | | | | Yellow jacket | |
| 6.2 % (5/80) | | | | | 0 % (0/4) | |
| Total egg | | | | | | |
| 5.9 % (1/17) | | | | | | |
| Cow milk | | | | | | |
| 5 % (1/20) | | | | | | |

were found to be the most common aeroallergens, egg and cow milk were reported to be the most common food allergens [19]. In a study from Vietnam, allergic sensitization was observed in 36.9% of the males and 31% of the females and the most common allergens were B. tropicalis, D. pteronyssinus, D. Farinae and cockroaches [20]. In a study from Brazil, allergic sensitization rates for some foods were as follows: 29.5% for fish, 24.4% for egg, 23.1 % for cow milk, 20% for wheat, 14% for peanut, and 4.8- 11.8 % for soybean [21]. In another study from Korea, allergic sensitization rates for some foods were as follows: 51.5% for egg, 31.2% for cow milk, 16.2% for peanut, and 15.4% for soybean [22]. These studies have revealed different sensitization rates in different regions. Accordingly, determining the most likely allergens for certain regions would provide us with target-driven tests, preventing unnecessary costs.

Consequently, we are of the opinion that detailed sIgE analyses from similar studies would enable us to determine those precise factors related to allergic diseases that would be most beneficial for the mapping of allergy frequency and allergen sensitivity in Turkey, which is increasing significantly day by day.

### *Competing interests*

The authors declare that they have no competing interests.

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