



Original Research

The Impact of the Pandemic on Cat and Dog Allergies

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Abstract

Objectives: The impact of the COVID-19 pandemic on allergic patients is not clearly understood. The aim of this study is to investigate the changes in sensitivity to cat and dog allergens in patients with respiratory allergies in Istanbul during the COVID-19 pandemic.

Methods: Before the pandemic (March 2018 - March 2020) and during and after the pandemic (March 2020 - March 2022), a total of 5499 patients who underwent skin testing were retrospectively evaluated. The patients' age, gender, diagnosis, total IgE, and eosinophil values were recorded. Patients were divided into two groups: 2-6 years old and 7 years and older. The frequency of sensitization to cats and dogs was investigated in both groups before and after the pandemic.

Results: The median age of the 5499 children included in the study was 77 months, with a range of 2 to 221 months. Furthermore, 55.7% of the children were male. Of the children, 59.1% were examined before the pandemic, and 40.9% during and after the pandemic. During the examinations, allergic rhinitis was identified in 1628 children (29.6%), asthma in 1829 children (33.3%), and both asthma and allergic rhinitis in 2042 children (37.1%). Allergies to cats were found in 247 children (4.5%), and to dogs in 166 children (3.0%). When comparing the age groups, the frequency of cat allergy in the 7-years and older group was found to have decreased compared to the pre-pandemic period, and the statistical difference was close to significance ($p=0.08$). However, regarding dog allergy, in the 7 years and older group, the sensitivity to dogs, which was 5.6% before the pandemic, had decreased to 2.6% during the pandemic, and this decrease was found to be statistically highly significant ($p<0.001$).

Conclusion: Environmental allergen exposure has a significant impact on the phenotype of allergic diseases. Changes in patients' lifestyles and increased time spent at home during the pandemic may have led to a decrease in contact with outdoor cat and dog allergens, resulting in a reduced frequency of cat and dog sensitivity. Additionally, the introduction of mask-distance-handwashing/disinfection rules during the pandemic is believed to have reduced contact with cat and dog allergens, potentially contributing to a decrease in allergy frequency.

Keywords: Allergy, cat allergy, childhood, dog allergy, pandemic

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Allergic diseases have become a global public health concern, affecting 30-40% of the world's population, with a significant portion of this population being children and young adults, according to the World Allergy Organization.

^[1] In recent years, the prevalence of allergic diseases has rapidly increased worldwide, particularly in low- and middle-income countries.^[2] Various factors, such as air pollution, exposure to cigarette smoke, urbanization, mold and humidity

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exposure, and lifestyle changes, contribute to changes in allergen prevalence.^[3] After the emergence of the coronavirus disease (COVID-19) in 2019, various pandemic measures were implemented worldwide. Public places such as restaurants, schools, parks, gardens, and workplaces were closed to prevent the spread of the virus. Various pandemic measures, including wearing masks, maintaining social distance, and practicing hand hygiene, were introduced. Outdoor entertainment activities were canceled, shopping malls were closed, and education shifted to a remote learning model. Occasionally, curfews were imposed.

The reduction in outdoor exposure and all these lifestyle changes may have altered allergen exposure and sensitivity in children with allergic rhinitis and asthma.^[4] While there are numerous studies on this topic, there is limited research specifically related to cat and dog allergies.^[5, 6] Cat and dog allergies are increasingly common, often causing respiratory allergic diseases, and cases of anaphylaxis have also been reported.^[7, 8] Allergic sensitivity to cats or dogs affects 25% of all children and adults.^[9] Unlike developed countries, in our country, cats and dogs are not only present indoors but also in many public and communal areas such as parks, gardens, and streets.

The skin prick test, used to determine cat and dog sensitivity, is a significant diagnostic tool for confirming IgE-mediated sensitivity to allergens. The skin prick test is highly useful for demonstrating sensitivity to environmental aeroallergens.^[10]

In this study, we aimed to assess the changes in cat and dog allergen sensitivity in patients with respiratory allergies in Istanbul during the pandemic period, using skin prick tests.

Methods

Patients

Patients under follow-up with a diagnosis of allergic rhinitis and/or asthma in the Pediatric Immunology and Allergy Outpatient Clinic were included in a retrospective study. The study included patients who underwent allergy skin testing during the pre-pandemic period (between March 2018 and March 2020) and the pandemic period and afterward (between March 2020 and March 2022). Patients were divided into two groups: 2-6 years old and 7 years and older (7-18 years old). The frequency of sensitization to cats and dogs before and after the pandemic was investigated.

Data were collected from the hospital database using recorded information such as patient code number, age, gender, diagnosis (allergic rhinitis and/or asthma), presence of cat and/or dog allergy (yes/no), presence of other chronic diseases, total IgE value, eosinophil value and percentage,

cat and/or dog skin prick test result, and histamine reaction size in the skin prick test. Patients with additional chronic diseases and those whose legal representatives did not provide consent were not included in the study.

The diagnosis of asthma was made according to the criteria of the Global Initiative for Asthma (GINA), while the diagnosis of allergic rhinitis was established based on the criteria of Allergic Rhinitis and its Impact on Asthma (ARIA).^[11, 12]

Laboratory

Skin Prick Test

Skin prick tests were conducted in the children's allergy clinic testing room using standard allergen extracts from Lofarma and a single-use Aller-tech 8-pronged skin prick test applicator. Following the standard procedure, the allergen extract was applied by dropping it onto the skin prick test applicator, and then it was pierced 1 mm deep into the dermis on both volar surfaces of the forearms. The skin prick test included histamine 0.1% (1 mg/mL) as a positive control and physiological saline as a negative control. Skin prick test results were evaluated 15 minutes after the application of allergen extracts following the recommendation of the European Academy of Allergy and Clinical Immunology (EAACI). A positive skin prick test result was considered when a wheal of 3 mm or more was observed compared to the negative control.

Serum Total IgE

The serum total IgE levels were measured in our laboratory using the nephelometric method. The results were reported in IU/ml.

Statistical Analysis

Following the coding of data obtained from the research, it was transferred to the computer and analyzed using the Statistical Package for Social Sciences (SPSS) software (Version 22 for Windows, SPSS Inc, Chicago, IL, USA). The normal distribution of all continuous variables in statistical analyses was assessed using the Kolmogorov-Smirnov Test. As continuous variables did not follow a normal distribution, the median (minimum and maximum values) was used for expression, while frequency (categorical) data were expressed in numbers and percentages (%). The non-parametric Mann-Whitney U Test was employed for the comparison of continuous variables between two groups. The non-parametric Kruskal Wallis test was used for comparisons involving more than two groups, and when necessary, the Bonferroni-corrected Mann-Whitney U Test was performed. Categorical data were compared using the chi-square test. The level of statistical significance was set at $p < 0.05$.

Ethics

Our study was conducted following the Helsinki Declaration and Good Clinical Practices principles. It was found ethically appropriate on 06.11.2023, with decision number 246.

Results

The median age of the 5499 children included in the study was 77 months, with a range of 2 to 221 months. Furthermore, 55.7% of the children were male. A total of 59.1% of the children were examined before the pandemic, and 40.9% were examined during and after the pandemic period. During the examinations, it was determined that 1628 children (29.6%) had rhinitis, 1829 (33.3%) had asthma, and 2042 (37.1%) had both asthma and rhinitis. Sensitivity to cats was observed in 247 (4.5%) children and sensitivity to dogs was observed in 166 (3.0%) of them. The laboratory characteristics of the patients before and during the pandemic are presented in Table 1.

In terms of diagnostic groups, there was no statistical difference in the frequency of cat and dog allergies ($p=0.29$ and $p=0.13$, respectively). However, when the median eosinophil count values were compared based on the diagnoses,

a significant difference was found ($p=0.043$). Nevertheless, further analyses revealed that this difference disappeared when the groups were compared pairwise ($p>0.05$). The laboratory variables based on the diagnoses are presented in Table 2.

The internal age-group comparison revealed that the frequency of cat allergy among those seven years and older had decreased compared to the pre-pandemic period, and the statistical difference was very close to significance ($p=0.08$). However, regarding dog allergy, the sensitivity to dogs among those seven years and older, which was 5.6% before the pandemic, had decreased to 2.6% during the pandemic period. This decrease was statistically significant ($p<0.001$). Comparisons of the cat and dog sensitivities between the age groups are presented in Table 3.

Discussion

The coronavirus disease epidemic has profoundly changed people's lifestyles and living environments, but although the physical and psychological effects of the COVID-19 epidemic on patients have been investigated, its effect on allergic diseases has rarely been investigated.^[13, 14] Despite

Table 1. Laboratory characteristics of patients in the pre-pandemic and pandemic periods

| Variables | Pre-pandemic | Post-pandemic | p |
|--|--------------------|---------------------|--------|
| Total IgE (IU/ml) * | 114.0 (1.0-5869.0) | 175.0 (0.6-12914.0) | <0.001 |
| Eosinophil count (n)* | 290.0 (0.0-4000.0) | 290.0 (0.0-4740.0) | 0.94 |
| Eosinophil percentage (%)* | 3.4 (0.0-45.3) | 3,7 (0.0-29,1) | 0.001 |
| Cat prick test positivity n (%) | 147 (4.5) | 100 (4.4) | 0.89 |
| Dog prick test positivity n (%) | 117 (3.9) | 49 (2.2) | 0.001 |
| Cat prick test reaction diameter (mm)* | 6.0 (2-16) | 6.0 (3-14) | 0.70 |
| Dog prick test reaction diameter (mm)* | 5.0 (3-15) | 5.0 (3-9) | 0.02 |

* Median (min-max).

Table 2. Laboratory variables according to diagnoses

| Variables | Rhinitis ^A (n:1628) | Asthma ^B (n:1829) | Rhinitis+Asthma ^C (n:2042) | p |
|---|--------------------------------|------------------------------|---------------------------------------|-----------|
| Total IgE (IU/ml) * | 131.5 (1.12-5200) | 147.0 (0.6-6882) | 131.7 (0.6-12914) | 0.066 |
| Eosinophil count (n) * | 280 (0-3200) | 300 (0-2700) | 280 (0-4740) | 0.043 |
| | | | | A-B: 1.0 |
| | | | | A-C: 0.07 |
| | | | | B-C: 0.11 |
| Eosinophil percentage (%)* | 3.5 (0-45.3) | 3.5 (0-25.3) | 3.5 (0-29.8) | 0.85 |
| Cat prick test positivity n (%) | 84 (5.2) | 76 (4.2) | 87 (4.3) | 0.29 |
| Dog prick test positivity n (%) | 57 (3.7) | 59 (3.4) | 50 (2.6) | 0.13 |
| Cat prick test reaction diameter (mm) * | 6.0 (2-14) | 7.0 (3-16) | 6.0 (3-13) | 0.53 |
| Dog prick test reaction diameter (mm) * | 5.0 (3-15) | 5.0 (3-10) | 5.0 (3-9) | 0.72 |

* Median (min-max).

Table 3. Comparison of cat and dog sensitivity between age groups across periods

| Age Group | Sensitization to Cats n (%) | Sensitization to Dogs n (%) | p for Cats | p for Dogs |
|-------------------|-----------------------------|-----------------------------|------------|------------|
| 2-6 years old | | | | |
| Pre-pandemics | 43 (2.4) | 42 (2.5) | 0.21 | 0.19 |
| Post-pandemics | 33 (3.2) | 18 (1.7) | | |
| 7 years and above | | | | |
| Pre-pandemics | 104 (7.2) | 75 (5.6) | 0.08 | <0.001 |
| Post-pandemics | 67 (5.6) | 31 (2.6) | | |

the knowledge that changes in lifestyle and living environment can affect individuals' allergic sensitivity.^[15]

In our study, which was conducted in Istanbul, we investigated the pet sensitivity of children during the pre-pandemic and pandemic periods. We found no change in the frequency of cat allergen sensitivity, while the sensitivity to dog allergens decreased in children aged seven and older. We believe that these results may be associated with lifestyle changes due to regulations aimed at controlling the pandemic.

Numerous studies have indicated an increase in indoor allergies during the COVID-19 pandemic.^[16] A study conducted in China, the first country affected by the pandemic, reported an increased sensitivity to indoor allergens, including house dust mites, cat epithelium, dog epithelium, and house dust, during the COVID-19 pandemic compared to the previous period. However, unlike our study, this study evaluated allergen sensitivity using serum-specific IgE results (4). It is known that skin prick tests have higher sensitivity and specificity compared to specific IgE measurements.^[17]

Furthermore, the distribution of allergens varies regionally depending on geographical environment, climate conditions, and lifestyle.^[18] In Türkiye, cats and dogs live not only in homes but also in public spaces such as parks and streets. Exposure to animals in these outdoor areas is considered more frequent and significant for the development of cat and dog allergen sensitivity than exposure in the home. The intensive measures introduced during the pandemic, such as the wearing of masks and restrictions on spending time in crowded and open areas, may have reduced children's exposure to allergens.

Similar to worldwide trends, the lifestyle changes brought about by the pandemic in Türkiye followed different age-based courses, especially for school-age children. For example, students could not attend school for more than a year (schools closed on March 16, 2020, and reopened on September 6, 2021). Furthermore, social and cultural activities and sports competitions for school-age students were canceled for an extended period. Thus, the impact of the

pandemic on allergen sensitivity in school-age children may have differed from that in the pre-school period.

In our study, lifestyle changes and increased time spent at home during the pandemic may have reduced exposure to dog allergens, leading to a decrease in dog allergen sensitivity in students aged seven and older. The continuous use of masks, maintenance of social distance, and attention to hand hygiene introduced during the pandemic may have reduced contact with dog allergens in school-age children, resulting in a decrease in allergen sensitivity.

In another study examining the impact of the COVID-19 pandemic on the frequency and exacerbation of allergic diseases in childhood, it was found that preventive measures during the COVID-19 outbreak played a protective role in reducing children's exposure to allergens and alleviating allergic reactions.^[5]

Wearing face masks during the pandemic may have also reduced allergen sensitivity in individuals with dog allergies. Some studies have demonstrated that wearing masks provides protection against allergy symptoms.

In a study investigating whether wearing masks could offer protection against allergy symptoms in individuals with pollen-induced allergic rhinoconjunctivitis, it was observed that masks reduced allergic symptoms.^[19]

Dror et al.^[20] reported in their study that mask use during the pandemic reduced allergic rhinitis symptoms.

In our study, no difference was observed in cat and dog allergen sensitivity among children aged 2-6. The fact that children in this age group spent more time indoors both before and during the pandemic, with already limited exposure to cats and dogs in social areas, may explain the lack of difference in cat and dog allergen sensitivity. Additionally, the age group's difficulty in adapting to masks, the challenge of wearing masks in this age group, and the fact that the masks provided at the beginning of the pandemic were adult-sized and not suitable for children's faces could have influenced the results.

Another aspect is that at the beginning of the pandemic, some people released their pets into the streets due to con-

cerns about the spread of the virus. However, as the mechanisms of virus transmission were understood over time and the duration of time spent at home during the pandemic increased, the rate of pet adoption also increased.^[21] How this dynamic might have changed pet allergen sensitization in patients is not fully understood.

In a retrospective study conducted in Türkiye, higher rates of cat sensitivity were found in patients who applied during the pandemic compared to the pre-pandemic period. In all skin prick tests performed during the pandemic period, 15% tested positive for cat sensitization, while in the pre-pandemic group, 4.4% had tested positive for cat sensitization. These results were thought to be related to the increased rate of cat adoption in the population.^[6]

Our study addressed a rarely studied topic. The strengths of our study include its large sample size and cross-sectional nature over a four-year period. Patients' allergen sensitivity was evaluated based on skin prick test results, as it is known that skin prick tests have higher sensitivity and specificity compared to other tests (specific IgE) in determining allergen sensitivity. However, our study has some limitations. Our hospital is one of the national clinical research centers focusing on children's health in Türkiye. The study was conducted in a single center, and the data were collected from children in our hospital. As such, the sample may not be fully representative of the characteristics of the general population.

Conclusion

In our study, we observed that the COVID-19 pandemic led to changes in the lifestyle of children, altering their allergen sensitivities. Being aware of the changes in allergen sensitivity and taking measures to avoid allergens will contribute to an effective approach to managing allergic diseases.

Disclosures

Ethics Committee Approval: It was found ethically appropriate by Prof. Dr. Cemil Tascioglu City Hospital on 06.11.2023, with decision number 246.

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors have no conflicts of interest to declare. They also declare that they didn't use any off-label or unapproved drugs or products. They didn't use previously copyrighted material.

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