



Impact of Direct and Indirect Cat Allergen Exposure Patterns on Allergic Rhinitis and Asthma in Cat-Sensitized Patients

Osman Ozan Yegit

University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital, Clinic of Adult Immunology and Allergy, Istanbul, Turkey

Abstract

Aim: Cat allergen hypersensitivity is a clinical condition that can affect patients across a wide spectrum, ranging from mild allergic rhinitis to severe asthma. Since cat hypersensitivity can occur through indirect exposure, non-cat owners also have the risk of developing cat allergies. The aim of this study was to investigate the effects of direct and indirect exposure patterns on the clinical features of allergic rhinitis and allergic asthma in patients with cat hypersensitivity.

Methods: In our study, designed as a retrospective cohort, the demographic and clinical characteristics of 257 patients diagnosed with cat allergy and allergic rhinitis who were followed up and treated between January 2022 and March 2023 were evaluated. Cat and non-cat owner patients were compared in terms of symptoms of allergic rhinitis, treatment steps for allergic rhinitis, and frequency, control and treatment steps for allergic asthma.

Results: The median (interquartile range) age of the patients was 29 (23-38), and 182 of them were female (70.8%). The visual analogue scale symptom scores of cat owners were significantly higher than those of non-cat owners ($p=0.022$ and $p=0.023$, respectively). The rate of moderate or severe allergic rhinitis that persisted despite treatment was higher in cat owners (31.8%) than in non-cat owners (17.8%). Additionally, allergic asthma frequency in cat owners with moderate or severe allergic rhinitis symptoms despite medical treatment was more common than in cat owners with mild rhinitis ($p=0.026$).

Conclusion: Direct exposure to cat allergens is associated with poor control of allergic rhinitis symptoms. These patients should avoid contact with cats. If avoidance is not possible, the clinical condition of these patients should be closely monitored, as they may have treatment-resistant respiratory allergies.

Keywords: Allergic, asthma, rhinitis

Introduction

Cat allergens are the second-most common indoor allergens, following house dust mites. The prevalence of cat allergies is estimated to be around 10-20% of the global population, and it reaches up to 20-30% in individuals with respiratory allergies (1-4).

Cat allergen hypersensitivity is commonly observed not only in cat owners but also in individuals who do not own cats (5,6). In Turkey, cats are often cared for in public spaces. Thus, it can be expected that the incidence of cat allergies will be higher among individuals who do not own cats. A previous study conducted in Izmir/Turkey revealed that 44.7% of non-cat owners with respiratory allergies

exhibited cat sensitivity (6). This finding suggests that in individuals without direct contact with cats, the significant presence of cat sensitivity can be attributed to substantial indirect exposure to cat allergens. Cat allergy has emerged as a significant health concern for both cat owners and non-owners, as it can lead to various and serious clinical conditions ranging from allergic rhinitis to asthma (5,7-10).

The severity of the symptoms of allergic rhinitis and asthma can vary depending on the level of exposure to allergens. Although cat owners often resist the idea of avoiding their cats, the primary management strategy in managing cat allergies is allergen avoidance, as in managing other allergies (1,5,11,12). However, in regions with a high indirect exposure risk to cat allergens,

Address for Correspondence: Osman Ozan Yegit, University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital, Clinic of Adult Immunology and Allergy, Istanbul, Turkey
Phone: +90 544 299 89 38 E-mail: drosmanozan@gmail.com ORCID: orcid.org/0000-0003-4256-6048

Received: 09.06.2023 **Accepted:** 09.08.2023

©Copyright 2023 by the Istanbul Haseki Training and Research Hospital
The Medical Bulletin of Haseki published by Galenos Publishing House.
Licensed by Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC-ND 4.0)



complete avoidance of cat allergens may not always be possible, even for individuals who do not own cats (6).

Investigating the effects of different cat allergen exposure patterns on allergic rhinitis and asthma in individuals with cat hypersensitivity can be beneficial for managing cat allergies. In this study, we aimed to explore the effects of both direct (cat owners) and indirect (non-cat owners) patterns of cat allergen exposure on the characteristics of allergic rhinitis and asthma.

Methods

Compliance with Ethical Standards

The study was started after obtaining approval from the Ethics Committee of the University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital (approval no: KAEK/2023.05.205, date: 26.05.2023). The medical records of the patients with allergic rhinitis between January 2022 and March 2023 in the Adult Immunology and Allergy Clinic of University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital were researched, and patients who had cat allergen sensitivity were evaluated. Informed consent was obtained from the patients participating in the study.

Study Design

All laboratory and clinical evaluation results used in the study were routinely obtained during patient examinations and were scanned retrospectively from medical records.

Skin prick test results, serum specific immunoglobulin E (IgE) levels, blood eosinophil counts, serum total IgE levels, pulmonary function test results, asthma control test (ACT) scores, and rhinitis visual analogue scale (VAS) symptom scores were all recorded on patient follow-up forms. Patients with a VAS symptom score less than 5 were considered to have mild rhinitis, and those with at least 5 were considered to have moderate to severe rhinitis (13). The Allergic Rhinitis and Its Impact on Asthma guideline was used to assess the severity of rhinitis and to determine the rhinitis treatment step (13). The Global Initiative for Asthma guideline was used to determine the asthma treatment step (14,15). The treatment steps for allergic rhinitis are shown in Table 1.

Comparisons were conducted between cat and non-cat owners in terms of allergic rhinitis symptoms, allergic rhinitis treatment steps, and asthma frequency, control and treatment steps.

Statistical Analysis

All analyses were performed with the IBM Statistical Package for Social Science version 25.0 (SPSS Inc., Chicago, IL, USA) for MacOS. Figures were developed in GraphPad Prism 9 (GraphPad Software, La Jolla, CA, USA) for MacOS. Descriptive data were given as percentages and as medians [interquartile range (IQR) 25-75]. The comparisons of VAS symptom scores, ACT scores, pulmonary function test results, blood eosinophil counts, serum total IgE, rhinitis medication scores, and asthma treatment step levels between the cat owners and non-cat owners were all performed with the Mann-Whitney U test. A comparison of rhinitis VAS symptom scores before and after medication was performed using the Wilcoxon test. Categorical variables were analyzed with the chi-square test. The results were assessed at a significant level of $p < 0.05$.

Results

Clinical and Demographic Characteristics of the Patients

A total of 257 patients with allergic rhinitis and cat allergen sensitivity were included in the study. The median (IQR) age of the patients was 29 (23-38), and 182 of them were female (70.8%). Sixty-eight (26.5%) patients had a concomitant diagnosis of asthma. While 66 (25.7%) patients were cat owners, 191 (74.3%) did not have any pets. Fifty-eight (22.6%) patients were only sensitive to cat allergens, while 169 (65.9%) had additional hypersensitivity (Table 2).

Effect of Medical Treatment on the Symptom Scores of Allergic Rhinitis

Before medical treatment, the median (IQR) VAS symptom score for allergic rhinitis was 7.0 (6.0-8.0) for all patients, 7.5 (6.0-9.0) for cat owners, and 7.0 (6.0-8.0) for noncat owners. After the treatment, the same score was observed: median (IQR) 3.0 (1.0-4.0) for all patients, median (IQR) 3.0 (2.0-5.0) for cat owners, and median (IQR) 2.0 (1.0-4.0) for non-cat owners. Post-treatment median (IQR) VAS scores for all groups were lower than before the treatment ($p < 0.001$ for each comparison) (Figure 1).

Table 1. Classification of treatments used in patients with allergic rhinitis (13,16)

1	Non-sedating H1-antihistamine (oral, intranasal, and ocular), leukotriene receptor antagonists, or promotes (intranasal and ocular)
2	INCSs
3	INCSs + intranasal azelastine
4	Oral corticosteroid as a short course and an add-on treatment
5	Consider referral to a specialist and allergen immunotherapy
INCSs: Intranasal corticosteroids	

Table 2. Clinical and demographic characteristics of the patients	
Gender, n (%)	
Female	182 (70.8%)
Male	75 (29.2%)
Median age (IQR)	
	29 (23-38)
Concomitant asthma (%)	
Yes	68 (26.5%)
No	189 (73.5%)
Cat owners, n (%)	
Yes	66 (25.7%)
No	191 (74.3%)
Atopies of the patients, n (%)	
Cat	58 (22.6%)
Cat and house dust mites	45 (17.5%)
Cats and pollens	20 (7.8%)
Cat, house dust mites and pollens	67 (26.1%)
Cat and dog	7 (2.7%)
Cats, house dust mites, pollens and dog	23 (8.9%)
Cat and <i>Blatella</i> spp.	3 (1.2%)
Cats, house dust mites, pollens, and <i>Blatella</i> spp.	14 (5.4%)
Cats, house dust mites, pollen, dogs, and <i>Blatella</i> spp.	20 (7.8%)
IQR: Interquartile range	

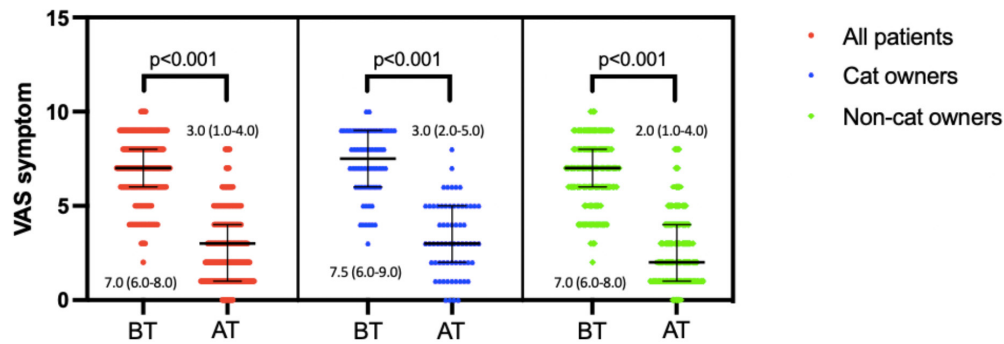


Figure 1. Effects of medical treatment on VAS symptom scores of allergic rhinitis. The figure shows the changes in symptom severity measured by VAS for patients diagnosed with allergic rhinitis before and after treatment. A decrease in VAS symptom scores was observed in all patient groups following allergic rhinitis treatment. Statistical analyses were conducted using the Wilcoxon test. AT: After treatment, BT: Before treatment, VAS: Visual analogue scale

The Effects of Being a Cat Owner on the Allergic Rhinitis Symptoms and Medication Scores

The initial and post-treatment VAS symptom scores of cat owners were significantly higher than those who do not have cats ($p=0.022$ and $p=0.023$, respectively) (Figure 2). On the other hand, while there was no relationship between the presence of moderate or severe rhinitis before medical treatment and direct exposure to cat allergens, patients with moderate or severe allergic rhinitis after treatment were mostly cat owners ($p>0.05$, $p=0.017$, respectively). Among cat owners, 31.8% had moderate or severe allergic rhinitis symptoms after receiving medical

treatment, whereas among non-cat owners, the rate was 17.8%. In addition, cat owners with moderate or severe rhinitis symptoms after medical treatment had a higher incidence of asthma than cat owners with mild rhinitis ($p=0.026$). The median (IQR) rhinitis medication scores were similar between cat owners 2.5 (2.0-3.0) and non-cat owners 2.0 (2.0-3.0) ($p>0.05$).

The Effects of Being a Cat Owner on Allergic Asthma

There was no difference between cat owners and non-cat owners in terms of asthma frequency, ACT scores, asthma treatment step, FEV1% predicted, FEV1/

FVC values, blood eosinophil count, and total IgE values ($p>0.05$ for each comparison) (Table 3).

The Effects of Patients Atopy Characteristics on Allergic Rhinitis and Asthma

The rate of monosensitization to cat allergen was higher in individuals who owned cats (34.8%) compared with those who did not own cats (18.3%) ($p=0.006$). However, being monosensitive to cat allergens or polysensitive to additional allergens did not show any significant impact on asthma frequency, ACT scores, or median (IQR) rhinitis VAS symptom scores ($p>0.05$ for each comparison).

Discussion

The study found that both pre-treatment and post-treatment rhinitis symptom scores were higher in cases of direct cat allergen exposure compared with indirect exposure. Additionally, among cat owners, a significant proportion continued to experience moderate to severe allergic rhinitis despite receiving medical treatment, and these individuals also demonstrated an increased frequency of asthma.

Cat allergy contributes to a wide range of allergic diseases, including allergic rhinitis and asthma (5,11). The high prevalence of exposure to cat allergens has made cat allergies a significant health concern not only among cat owners but also among individuals who do not have direct contact with cats (6,17). A previous study in the Istanbul region found that cat sensitivity in non-cat owners was a risk factor for poor quality of life in allergic rhinitis (17). In our study, since we did not include a group of patients without cat sensitivity, we did not obtain similar results. However, we demonstrated that cat owners with more direct cat allergen contact had higher allergic rhinitis symptom scores compared with non-cat owners. Data from studies conducted in the Istanbul region, where high rates of indirect cat allergen exposure are expected due to the high population of street cats, are particularly relevant for clinicians specializing in respiratory allergies in this region. Clinicians can potentially achieve improvements in symptom scores by advising measures to avoid cat allergen exposure, including implementing household precautions, in this patient group.

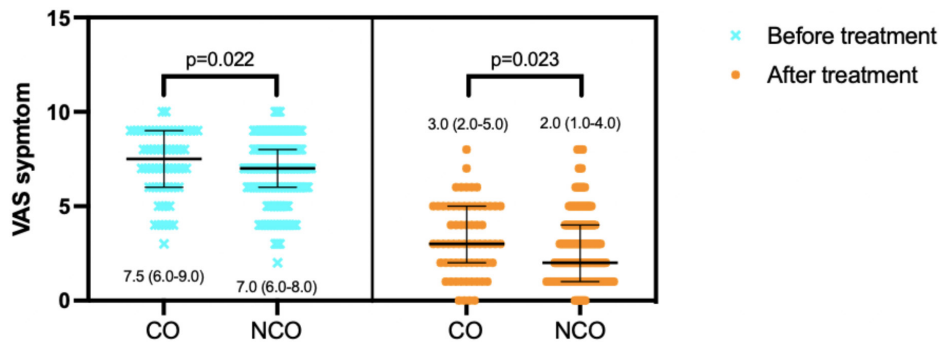


Figure 2: Effects of being a cat owner on the VAS symptom scores of allergic rhinitis. The figure demonstrates the difference in symptom severity of allergic rhinitis measured by VAS between cat and non-cat owners. Both before and after medical treatment, cat owners had higher allergic rhinitis VAS symptom scores compared with those who did not own cats. Statistical analyses were conducted using the Mann-Whitney U test.

CO: Cat owner, NCO: Non-cat owner, VAS: Visual analogue scale

	Cat owners	Non-cat owners	p-value
Concomitant asthma (%)			
Yes	23 (8.9%)	45 (17.5%)	NS
No	43 (16.7%)	146 (56.8%)	
Asthma control test score	22.0 (20.0-24.0)	23.5 (20.0-25.0)	NS
Asthma treatment step	3.0 (2.0-4.0)	3.0 (1.0-3.0)	NS
FEV1 (% predicted)	95.5 (90.3%-102.0%)	92.0 (85.8%-101.3%)	NS
FEV1/FVC	85.0 (84.0-90.0)	84.5 (76.3-89.5)	NS
Blood eosinophil count (cell/mL)	135.0 (52.0-537.0)	210.0 (90.0-620.0)	NS
Total IgE (kU/L)	261.5 (7.5-1705.8)	215.0 (30.0-874.0)	NS

There were no significant differences observed between cat and non-cat owners in terms of concomitant asthma, ACT score, asthma treatment step, pulmonary function test results, blood eosinophil count, and serum total IgE level.
FEV1: Forced expiratory volume in one second, FVC: Forced vital capacity, IgE: Immunoglobulin E, NS: Not significant

In recent studies, although pet animal feeding is not listed among the risk factors for asthma, exposure to triggers is considered one of the factors that disrupt asthma control (18-24). It is expected that direct exposure through intense contact may have a greater negative impact on asthma control compared with indirect exposure. However, our study did not find any significant differences between the direct and indirect exposure groups in terms of asthma severity, control, or frequency, unlike the differences observed in allergic rhinitis. On the other hand, cat owners with moderate or severe rhinitis had a higher prevalence of asthma compared with those with mild rhinitis. The absence of this relationship in the group with indirect exposure suggests that more intense contact with cat allergens may also contribute to an increased number of individuals with asthma who have comorbid moderate or severe allergic rhinitis.

The population of street cats is high not only in Istanbul but also in many other cities in Turkey. In a previous study from Ankara/Turkey, cat allergen sensitivity was shown to be a risk factor for increased timothy allergen sensitivity (25). However, we could not have a similar encounter because there were no non-cat allergen-sensitive individuals in our study group. On the other hand, when we looked at the effect of monosensitization with cats or polysensitization with a concomitant allergen on the clinical conditions of asthma or rhinitis, we did not observe any difference.

When evaluating other clinical characteristics based on cat allergen exposure patterns, there was no significant difference in medical treatment scores among patients diagnosed with asthma and/or rhinitis ($p > 0.05$ for each comparison). In both groups, allergic rhinitis symptom scores significantly improved after medical treatment ($p < 0.001$ for each comparison). However, the prevalence of moderate or severe rhinitis despite the treatment was significantly higher in cat owners (31.8%) compared with non-cat owners (17.8%) ($p = 0.017$).

Study Limitations

A potential limitation of this study is its retrospective design. Additionally, the lack of a patient group without cat allergen hypersensitivity hindered the comparison between individuals with and without cat allergies. On the other hand, our study used a large dataset of patients and yielded valuable data on allergen exposure patterns. To the best of our knowledge, this is the first study conducted with a large number of patients diagnosed with cat allergy and allergic rhinitis, aiming to investigate the effects of cat allergen exposure patterns on both allergic rhinitis and asthma in the Istanbul region.

Conclusion

When individuals have cat allergen hypersensitivity and continue to own a cat, it is associated with poorer control of allergic rhinitis symptoms and a higher prevalence of asthma in those with moderate to severe allergic rhinitis. It is recommended that these patients avoid contact with cats if possible. However, for those who cannot comply with this recommendation, their clinical condition should be closely monitored, as they may have treatment-resistant respiratory allergies. Additionally, it should be kept in mind that even among patients who do not own cats, there may be a high prevalence of cat allergen hypersensitivity due to indirect exposure, and an increase in direct contact with cats may lead to poor symptom control in these patients.

Ethics

Ethics Committee Approval: The study was started after obtaining approval from the Ethics Committee of the University of Health Sciences Turkey, Basaksehir Cam and Sakura City Hospital (approval no: KAEK/2023.05.205, date: 26.05.2023).

Informed Consent: Informed consent was obtained from the patients participating in the study.

Peer-review: Externally peer-reviewed.

Financial Disclosure: The author declare that this study has received no financial support.

References

1. Sparkes AH. Human allergy to cats: A review of the impact on cat ownership and relinquishment. *J Feline Med Surg* 2022;24:43-52.
2. Chan SK, Leung DYM. Dog and cat allergies: current state of diagnostic approaches and challenges. *Allergy Asthma Immunol Res* 2018;10:97-105.
3. Dharmage SC, Lodge CL, Matheson MC, Campbell B, Lowe AJ. Exposure to cats: update on risks for sensitization and allergic diseases. *Curr Allergy Asthma Rep* 2012;12:413-23.
4. Morris DO. Human allergy to environmental pet danders: a public health perspective. *Vet Dermatol* 2010;21:441-9.
5. Dávila I, Domínguez-Ortega J, Navarro-Pulido A, et al. Consensus document on dog and cat allergy. *Allergy* 2018;73:1206-22.
6. Gulbahar O, Sin A, Mete N, Kokuludag A, Kirmaz C, Sebik F. Sensitization to cat allergens in non-cat owner patients with respiratory allergy. *Ann Allergy Asthma Immunol* 2003;90:635-9.
7. Nilsson OB, van Hage M, Grönlund H. Mammalian-derived respiratory allergens -implications for diagnosis and therapy of individuals allergic to furry animals. *Methods* 2014;66:86-95.

8. Konradsen JR, Fujisawa T, van Hage M, et al. Allergy to furry animals: new insights, diagnostic approaches, and challenges. *J Allergy and Clin Immunol* 2015;135:616-25.
9. Severcan EU, Başkaya N, Ertuğrul A, Emeksiz ZŞ, Bostancı I. Characteristics of children with cat sensitivity: a prospective cross-sectional study. *Turk J Med Sci* 2023;53:360-5.
10. Liccardi G, Passaacqua G, Salzillo A, et al. Is Sensitization to Furry Animals an Independent Allergic Phenotype in Nonoccupationally Exposed Individuals? *J Investig Allergol Clin Immunol* 2011;21:137-41.
11. Portnoy JM, Kennedy K, Sublett JL, et al. Environmental assessment and exposure control: a practice parameter–furry animals. *Ann Allergy Asthma Immunol* 2012;108:223.
12. McNicholas J, Gilbey A, Rennie A, Ahmedzai S, Dono JA, Ormerod E. Pet ownership and human health: a brief review of evidence and issues. *BMJ* 2005;331:1252-4.
13. Bousquet J, Schünemann HJ, Togias A, et al. Next-generation Allergic Rhinitis and Its Impact on Asthma (ARIA) guidelines for allergic rhinitis based on Grading of Recommendations Assessment, Development and Evaluation (GRADE) and real-world evidence. *J Allergy Clin Immunol* 2020;145:70-80.
14. Levy ML, Bacharier LB, Bateman E, et al. Key recommendations for primary care from the 2022 Global Initiative for Asthma (GINA) update. *NPJ Prim Care Respir Med* 2023;33:7.
15. 2023 GINA Report, Global Strategy for Asthma Management and Prevention. <https://ginasthma.org/2023-gina-main-report/>
16. Courbis AL, Murray RB, Arnavielhe S, et al. Electronic clinical decision support system for allergic rhinitis management: MASK e-CDSS. *Clin Exp Allergy* 2018;48:1640-53.
17. Aslier NGY, Saatçi Ö, Aslier M. Disease and Quality of Life Aspects of Cat Allergy in Non-Pet Owners with Allergic Rhinitis. *Int Arch Allergy Immunol* 2023;184:625-33.
18. Porsbjerg C, Melén E, Lehtimäki L, Shaw D. Asthma. *Lancet* 2023;401:858-73.
19. GBD 2019 Chronic Respiratory Diseases Collaborators. Global burden of chronic respiratory diseases and risk factors, 1990-2019: an update from the Global Burden of Disease Study 2019. *EClinicalMedicine* 2023;59:101936.
20. Mphahlele R, Lesosky M, Masekela R. Prevalence, severity and risk factors for asthma in school-going adolescents in KwaZulu Natal, South Africa. *BMJ Open Respir Res* 2023;10:e001498.
21. Nappi E, Paoletti G, Malvezzi L, et al. Comorbid allergic rhinitis and asthma: important clinical considerations. *Expert Rev Clin Immunol* 2022;18:747-58.
22. Papadopoulos NG, Miligkos M, Xepapadaki P. A Current Perspective of Allergic Asthma: From Mechanisms to Management. *Handb Exp Pharmacol* 2022;268:69-93.
23. Cazzola M, Rogliani P, Ora J, Calzetta L, Matera MG. Asthma and comorbidities: recent advances. *Pol Arch Intern Med* 2022;132:16250.
24. Shipp CL, Gergen PJ, Gern JE, Matsui EC, Guilbert TW. Asthma Management in Children. *J Allergy Clin Immunol Pract* 2023;11:9-18.
25. Bostan OC, Cakmak ME, Kaya SB, et al. The association of timothy grass allergy and cat ownership on cat sensitization. *Allergy Asthma Proc* 2022;43:220-5.