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RESEARCH ARTICLE

Characteristics of the patients with asthma-rhinitis multimorbidity

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ABSTRACT

Characteristics of the patients with asthma-rhinitis multimorbidity

Introduction: *Asthma and allergic rhinitis frequently coexist and have been regarded as a single airway disease. Clinical features of patients with asthma-rhinitis multimorbidity may change depending on the allergic sensitization pattern. The aim of our study is to determine the frequency, type, and characteristics of the patients with asthma-rhinitis multimorbidity.*

Materials and Methods: *Patients who were followed up with a diagnosis of asthma between 2015 and 2020 in our clinic were included in our cross-sectional study. Sociodemographic and clinical characteristics of the patients, rhinitis symptoms, and atopy status according to the results of the skin prick test, and sp IgE were recorded from the patient files.*

Results: *Asthma-rhinitis multimorbidity was seen in 138 (113 F/25 M) out of 405 asthmatics and the mean age was 45.51 ± 13.56 years. They were younger and the age of onset of asthma was earlier than asthma patients without rhinitis. The rate of concomitant allergic rhinitis (AR) was 25.9%, and the rate of non-allergic rhinitis (NAR) was 8.1% in the entire group. There was no difference between patients with AR and NAR in terms of comorbidities such as NSAID sensitivity, nasal polyps, chronic rhinosinusitis, and bronchiectasis but, gastroesophageal reflux disease was more common in those with NAR than in those with AR (39.4%, 18.1%, respectively, p= 0.01). Of 105 asthmatic patients accompanied by allergic rhinitis, 41 (39.09%) were monosensitized, and 64 (60.95%) were polysensitized. House dust mites were found to be the most common responsible allergen in monosensitized patients. Sensitization to two allergens was the most common pattern among polysensitized patients, and mites and mold association was the most frequent. Patients with monosensitized allergic rhinitis had more severe asthma and a higher rate of NSAID sensitivity than polysensitized patients (p= 0.03, p= 0.04, respectively). There was no difference in the control level, frequency of eosinophilia, and other comorbidities.*

Conclusion: *Our patients with asthma-rhinitis multimorbidity were mostly polysensitized. The most responsible allergen for the sensitization was house dust mites, regardless of whether the patient was monosensitized or polysensitized.*

Key words: *Asthma; allergic rhinitis; nonallergic rhinitis; polysensitization; asthma-rhinitis multimorbidity; house dust mites*

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ÖZ

Astım-rinit multimorbiditeli hastaların özellikleri

Giriş: *Astım ve alerjik rinit birlikteliğinin sık olduğu bilinmektir ve artık tek hava yolu hastalığı kavramı benimsenmiştir. Bu iki hastalığın birlikteliği astım kontrolünü ve yaşam kalitesini olumsuz etkilemektedir. Alerjik rinit hastalarının duyarlanma paternine göre hem astım ile birliktelikleri hem de klinik özellikleri değişebilmektedir. Çalışmamızın amacı, astımlı hastalarımızda rinit sıklığını, tipini ve özelliklerini belirlemekti.*

Materyal ve Metod: *Kesitsel tipte olan çalışmamıza 2015-2020 yılları arasında astım tanısıyla takip ettiğimiz hastalar dahil edildi. Hasta dosyalarından, hastaların sosyodemografik ve klinik özellikleri, rinit semptomları ve atopi durumlarını değerlendiren deri prick testi ve sp IgE sonuçları kaydedildi.*

Bulgular: *Kliniğimizde 2015-2020 yılları arasında astım tanısıyla izlediğimiz toplam 405 hastanın yaş ortalaması 45,51 ± 13,56 olan 138'inde (113 K/25 E) rinit eşlik ediyordu. Rinit eşlik eden astımlılar diğerlerinden daha gençti ve astım daha erken başlıyordu. Bu hastaların 105'i atopik, 33'ü nonatopikti. Dolayısıyla, astımlı hastalarımızda alerjik rinit (AR) eşlik etme oranı %25,9 iken, nonalerjik rinit (NAR) oranı %8,1 bulundu. Alerjik rinit ve NAR olan hastalar arasında NSAII duyarlılığı, nazal polip, kronik sinüzit, bronşektazi gibi komorbiditeler açısından fark yoktu; gastroözefageal reflü hastalığı NAR'lilerde AR'lilere göre daha sıktı (sırasıyla, %39,4, %18,1, p= 0,01). İki grup arasında eşlik eden astım fenotipi, kontrolü ve ağırlığı yönünden fark bulunmadı (p> 0,05). Alerjik rinitli hastaların NAR'lilerden daha genç olduğu görüldü. Alerjik rinitin astıma eşlik ettiği 105 astımlı hastanın 41'i (%39,09) monosensitize, 64'ü (%60,95) polisensitize idi. Monosensitize olan hastalarda ev tozu en sık sorumlu alerjen olarak bulunurken, polisensitize hastalar arasında sıklıkla iki alerjene duyarlanmanın olduğu ve ev tozu akarı ve küf mantarı birlikteliğinin en sık görüldüğü, çimen, ağaç ve tahıl polenlerinin ikili kombinasyonlarının bunu izlediği saptandı. Monosensitize alerjik rinitli hastalar polisensitize hastalara göre daha fazla ağır astıma sahipti (p= 0,03) ve NSAI duyarlılığı daha fazlaydı (p= 0,04). Monosensitize ve polisensitize hastalar arasında astım kontrol düzeyi, eozinofili ve komorbiditelerin sıklığı açısından fark saptanmadı (p> 0,05).*

Sonuç: *Astım ve alerjik rinit birlikteliğinin olduğu hastalarımız çoğunlukla polisensitizeydi ve monosensitize ya da polisensitize olması farketmeksizin duyarlanmadan en fazla sorumlu alerjen ev tozu olarak görülmektedir.*

Anahtar kelimeler: *Astım; rinit; polisensitizasyon; astım-rinit multimorbiditesi; ev tozu akarı*

INTRODUCTION

Asthma and allergic rhinitis (AR) are diseases that often accompany each other and progress with chronic inflammation of the respiratory tract, with common pathogenetic mechanisms. While asthma accompanies 10-40% of AR patients, AR has been reported in 30-80% of the asthmatics (1). Because of similar epidemiological data, risk factors, and pathogenesis, these two conditions are defined as a single airway disease (2). While asthma is a chronic inflammation of the lower airways with variable airway obstruction (3), AR is the most common form of non-infectious rhinitis, affecting 10-30% of all adults and causing symptoms such as runny nose, itching, sneezing, and nasal congestion (4).

Nasal epithelial involvement and mucosal inflammation are detected even in asthmatic patients without AR symptoms, whereas eosinophilic inflammation and a mild basement membrane thickening can be seen in the lower airways of AR patients without asthma symptoms (5). Therefore, detailed questioning of patients with AR or asthma diagnosis is important to evaluate the association.

The coexistence of asthma and rhinitis, which is known as asthma-rhinitis multimorbidity, affects the quality of life more than either disease alone. Asthma control has been reported to be worse in patients with asthma-rhinitis multimorbidity than in patients with asthma alone (6,7).

When evaluated according to the sensitization pattern, polysensitization is common in AR patients. Compared to monosensitized patients, polysensitized subjects have earlier disease onset, severe rhinitis symptoms, and accompanied asthma more frequently (8,9). Moreover, polysensitization was found to be associated with more symptoms, impaired lung functions, and lower quality of life in asthmatic patients (10,11).

In this study, we identified patients with rhinitis among the patients followed up with the diagnosis of asthma, and our aim was to evaluate the frequency, type, and characteristics of asthma-rhinitis multimorbidity patients followed up in our outpatient clinic.

MATERIALS and METHODS

This observational and cross-sectional study was conducted in accordance with the Declaration of Helsinki and was approved by the Ankara University Ethics Committee (Approval no: İ05-253-22). All patients signed the written informed consent form and allowed their files to be evaluated retrospectively.

Patients who were diagnosed with asthma according to the GINA guidelines (3) and followed up in our outpatient clinic between 2015-2020 were included in the study.

Rhinitis symptoms and the presence of atopy were questioned. House dust mites (*Dermatophagoides pteronyssinus*, *Dermatophagoides farinea*), grass pollen, tree pollen, cereal pollen, mold (*Alternaria alternata*, *Aspergillus fumigatus*), animal epithelia (cat and dog), and latex sensitivities as common aeroallergens were evaluated by allergy tests. Patients with a positive skin prick test and/or sp IgE results were considered atopic.

Patients with an absolute eosinophil count of 300/μL or above during the corticosteroid-free period at least once during the follow-up, or 150/μL and above under oral corticosteroid therapy were defined as eosinophilic. Patients were classified as non-eosinophilic if the absolute eosinophil count in at least three measurements did not reach 300/μL during the oral corticosteroid-free period or 150/μL during corticosteroid therapy (3).

In terms of accompanying rhinitis symptoms such as runny nose, itching, sneezing, and congestion, patients with symptoms lasting two or more consecutive days, often longer than one hour, were considered to have rhinitis. Atopic patients who experienced rhinitis symptoms after exposure to an allergen that was positive in allergy tests were considered to have allergic rhinitis. Patients who described rhinitis symptoms but had negative allergy tests were evaluated as nonallergic rhinitis (NAR) (2). Sensitization to a single allergen group (mite/mold/grass pollen/cereal pollen/tree pollen/animal dander) was classified as monosensitization, while sensitivity to two or more allergens was classified as polysensitization. Since we could not perform component-resolved analysis, patients sensitive to grass and cereal pollen could not be examined for cross-sensitivity and counted as separate sensitizations.

Demographic characteristics, presence of concomitant nasal polyps, chronic rhinosinusitis (CRS), gastroesophageal reflux disease (GERD), bronchiectasis, and NSAID sensitivity data were recorded from the files.

According to the age of onset of asthma; early-onset was defined as under 18 years of age, adult-onset between 18-40 years, and late-onset as 40 years or older (9,12).

Asthma severity was evaluated according to the GINA guidelines. Accordingly, these patients were classified as severe asthma if asthma control could only be achieved with steps 4-5 treatment despite the correct inhaler technique, management of comorbidities, and avoidance of triggers. Asthma control was assessed with the asthma control test (ACT) (3).

RESULTS

Four hundred and five patients, followed up with the diagnosis of asthma were evaluated. While 185 patients (45.7%) were atopic, 220 (54.3%) were nonatopic. Most of the patients had adult- or late-onset asthma (56%, and 35%, respectively), while 8.6% had early-onset asthma. Mean asthma onset age was calculated as 34.64 ± 12.12 years. When the demographic characteristics of the patients were evaluated according to accompanying rhinitis; 138 asthmatic patients had rhinitis and 267 patients did not. Asthma patients with rhinitis were younger, the age of onset of asthma was earlier and their pulmonary functions were better than subjects without rhinitis (Table 1).

According to the sensitization patterns, 89 patients (48.1%) were monosensitized and 96 (51.9%) were polysensitized. Mostly, our asthma patients were sensitive to mites, grass pollen, tree pollen, cereal pollen, mold, and animal epithelium (57.8%, 44.3%, 29.2%, 29.2%, 19.4%, and 10.3%, respectively). The distribution of patients according to the allergen sensitivity and combinations of concomitant allergens in polysensitized patients were given in Figure 1.

Of the atopic patients, 105 described rhinitis symptoms with the allergens that they were sensitive to, and these patients were classified as AR. Rhinitis symptoms were more common in polysensitized patients than in monosensitized patients (66.7%, 46.1%, p= 0.005). On the other hand, 33 of the nonatopic patients had rhinitis symptoms and were considered NAR. As a result, in a total of 138 rhinitis patients with a mean age of 45.51 ± 13.56 (113 F/25 M) were evaluated. While the rate of accompanying AR was 25.9% in our asthmatic patients, the rate of NAR was 8.1%. Although not significant, patients with allergic rhinitis were younger and the age of asthma onset was also earlier in AR than in NAR patients. There was no difference between AR and NAR patients in terms of the frequency of comorbidities such as NSAID sensitivity, nasal polyps, CRS, and bronchiectasis, but GERD was more common in

Table 1. Demographic features of the asthmatic patients with or without rhinitis

		Asthmatics with rhinitis (n= 138), n (%)	Asthmatics without rhinitis (n= 267), n (%)	p
Age (mean ± SD)		45.51 ± 13.56	51.71 ± 12.75	<0.001
Male/female		25 (18.1)/113 (81.9)	58 (21.7)/209 (78.3)	0.43
NSAID sensitivity		22 (15.9)	54 (20.2)	0.34
Nasal polyposis		29 (21)	59 (22.1)	0.89
Chronic sinusitis		24 (17.4)	50 (18.7)	0.78
Bronchiectasis		6 (4.3)	19 (7.1)	0.38
GERD		32 (23.2)	75 (28.1)	0.34
Obesity		49 (35.5)	125 (46.8)	0.18
The onset age of asthma (mean ± SD)		30.84 ± 12.10	36.60 ± 11.68	<0.001
Asthma onset	Early-onset	19 (13.8)	16 (6)	<0.001
	Adult-onset	87 (63)		140 (52.4)
	Late-onset	32 (23.2)		111 (41.6)
Asthma phenotype	Eosinophilia	69 (50)	136 (50.9)	0.91
	Non-eosinophilia	69(50)		131 (49.1)
Severity of asthma	Severe	80 (58)	168 (62.9)	0.40
Control of asthma	Total	92 (66.7)	175 (65.5)	0.96
	Partial	7 (5.1)		13 (4.9)
	Uncontrolled	39 (28.3)		79 (29.6)
ACT (mean ± SD)		22.34 ± 3.57	22.51 ± 3.78	0.65
Number of asthma attacks (mean ± SD)		0.35 ± 0.63	0.37 ± 0.72	0.79
Pulmonary function tests (mean ± SD)	FEV_1 %	83.23 ± 20.34	80.15 ± 20.85	0.15
	FEV_1 mL	2.21 ± 0.81	1.99 ± 0.73	0.01
	FEV_1/FVC	75.02 ± 10.44	73.18 ± 9.62	0.08

NAR patients than AR patients (39.4%, 18.1%, respectively, p= 0.01). In addition, there was no difference between these two groups in terms of inflammatory characteristics, control, and severity of asthma (Table 2).

When the sensitization patterns of 105 patients with asthma-rhinitis multimorbidity were analyzed, 41 (39.09%) were monosensitized and 64 (60.95%) were polysensitized. House dust mites were the most commonly responsible allergens in monosensitized patients. Polysensitized patients were frequently sensitized to two allergens, and the most common allergens were a combination of house dust mites and mold. This was followed by binary combinations of grass, tree, and cereal pollen (Figure 2). As a perennial allergen, 70.1% of patients sensitive to house dust mites, had severe asthma (p= 0.03). However, no association was found between asthma control and house dust mite sensitivity. On the other hand, other perennial allergens (mold and animal dander) and seasonal allergens (grass, cereal, and tree) were not associated with asthma severity or control.

Among Aspergillus sensitive patients 4/17 were diagnosed with allergic bronchopulmonary aspergillosis (ABPA). Of 22 patients sensitive to Alternaria, one had a diagnosis of ABPA but this patient was also sensitive to Aspergillus. The diagnosis of allergic bronchopulmonary mycosis could not be excluded because mold sensitivity to those other than *Aspergillus fumigatus* such as *Aspergillus niger*, *Aspergillus flavus*, Penicillium, and Candida was not examined. The rates of severe asthma and NSAID sensitivity were higher in monosensitized patients, while the level of asthma control, eosinophilia, and the frequency of comorbidities were not different in monosensitized AR patients compared to polysensi-

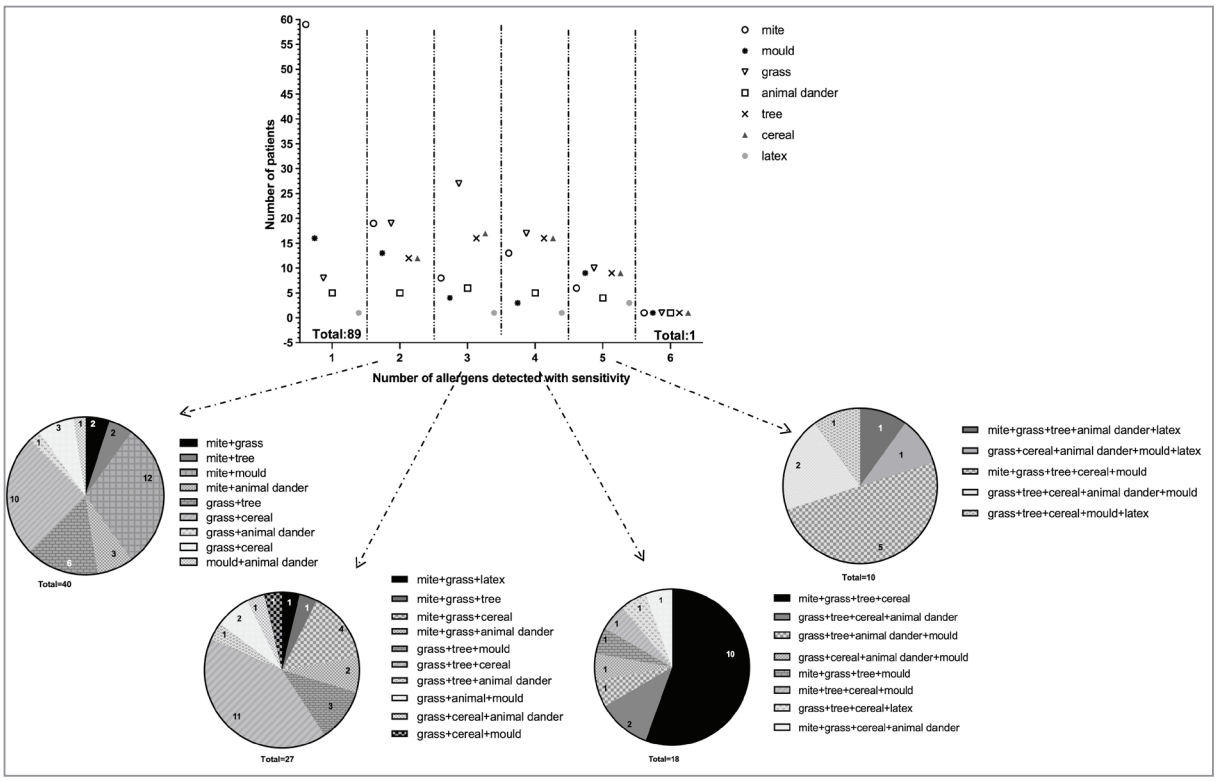

Figure 1. Sensitization profile of monosensitized and polysensitized asthma patients.

tized AR patients (73.2% vs 51.2%, p= 0.03; 21.4% vs 9.4%, p= 0.04, respectively) In addition, pulmonary functions were worse in monosensitized patients compared to polysensitized ones (Table 3).

DISCUSSION

Our study showed that nearly one-third of the asthma patients had asthma-rhinitis multimorbidity and 76% of these asthma-rhinitis multimorbid patients had allergic rhinitis. Asthma patients with rhinitis were younger, their asthma started earlier, and their pulmonary functions were better than others. Most of them were polysensitized. In terms of the sensitization patterns, it was observed that sensitization to two allergens was the most common pattern and positivity to house dust mites and molds was found to be the most frequent. A combination of tree, grass, and cereal pollen was the most common among those who were sensitive to three allergens, monosensitized patients were most sensitive to house dust mites. Asthma course was more severe, pulmonary functions were worse and NSAID sensitivity was more common in monosensitized, especially in HDM sensitized patients, than polysensitized patients. No difference was observed in terms of asthma control and other comorbidity rates.

The rate of allergic rhinitis in our asthmatic patients was found to be 25.9% and this was lower than the rate of 60-80% reported in the literature (2,13). The fact that the majority of our patient population consisted of adult patients with late-onset asthma and that the majority of the prevalence studies in the literature included pediatric cases were thought to be related to this situation. Furthermore, it has been reported that the rate of atopy is low in late-onset asthma patients, while the frequency of nonallergic rhinitis is higher (9). Results of the longitudinal birth cohorts reported that irrespective of IgE sensitization multimorbidities of allergic diseases were associated with the persistence of disease, and nonallergic patients tended to have chronic sinusitis and nasal polyposis more frequently than allergic patients (8,14). However, unlike this hypothesis, we did not find a difference between the allergic and nonallergic patients in terms of chronic sinusitis and nasal polyposis. We hypothesized that this may be due to the fact that nearly half of both groups were eosinophilic and therefore presented type-2 endotypical features.

Table 2. Demographic features of the patients with asthma-rhinitis multimorbidity

		AR (n= 105), n (%)	NAR (n= 33), n (%)	p
Age (mean ± SD)		44.62 ± 13.76	48.33 ± 12.72	0.12
Male/female		23 (21.9)/82 (78.1)	2 (6.1)/31(93.9)	0.02
NSAID sensitivity		16 (15.2)	6 (18.2)	0.78
Nasal polyposis		23 (21.9)	6 (18.2)	0.80
Chronic sinusitis		19 (18.1)	5 (15.2)	0.79
Bronchiectasis		5 (4.8)	1 (3)	1.00
GERD		19 (18.1)	13 (39.4)	0.01
Obesity		36 (34.3)	13 (39.3)	0.86
The onset age of asthma (mean ± SD)		30.52 ± 12.43	31.87 ± 11.09	0.55
Asthma onset	Early-onset	16 (15.2)	3 (9.1)	0.61
	Adult-onset		66 (62.9)	21 (63.6)
	Late-onset		23 (21.9)	9 (27.3)
Asthma phenotype	Eosinophilia	52 (49.5)	17 (51.5)	1.00
	Non-eosinophilia		53 (50.5)	16 (48.5)
Severity of asthma	Severe	62 (59)	18 (54.5)	0.76
Control of asthma	Total	72 (68.6)	20 (60.6)	0.44
	Partial		6 (5.7)	1 (3)
	Uncontrolled		27 (25.7)	12 (36.4)
ACT (mean ± SD)		22.60 ± 3.37	21.52 ± 4.07	0.12
Number of asthma attacks (mean ± SD)		0.32 ± 0.6	0.42 ± 0.7	0.43
Pulmonary function tests (mean ± SD)	FEV_1 %	82.88 ± 20.22	84.33 ± 20.99	0.72
	FEV_1 mL	2.27 ± 0.85	2.00 ± 0.63	0.05
	FEV_1/FVC	75.43 ± 10.94	73.75 ± 8.68	0.42

Moreover, it should be taken into account that some AR patients were also diagnosed with ABPA, which means that they were accompanied by chronic sinusitis. On the other hand, when NAR and AR patients were compared, GERD was found to be more common in NAR than in AR patients. In a study from Italy including 2887 cases, GERD was shown to accompany NAR more than AR, and it was reported that GERD was strongly associated with NAR (15). In another study, pepsin level in the saliva was found to be increased in the postprandial period in NAR patients compared to healthy controls (16).

In the MeDALL study, it was reported that monosensitized and polysensitized patients presented with two different phenotypes (14). In our study, consistent with the publications reporting that asthma-rhinitis multimorbidity is frequently seen in polysensitized patients in adults (17-20), rhinitis symptoms were more common in polysensitized asthmatic patients than monosensitized patients. Another study conducted in children with allergic rhinitis, similar to our study, reported that the rate of polysensitization was higher than monosensitization, and there was no difference in symptom severity between polysensitized and monosensitized patients (21). However, in contrast to this study and some other studies in the literature (10,11), we found that our monosensitized patients had more severe asthma with worse lung function than polysensitized patients. We think that this may be secondary to the fact that it was a cross-sectional study conducted in a tertiary hospital, the study population was all adults, and included a large number of severe asthma patients.

Our AR patients were mostly sensitive to house dust mites. Similar to our results, in a study conducted in Hungary, 964 patients were evaluated and it was reported that sensitization to house dust mites, fungi, and mixtures of weed was dominant (22). In a previous study in children in the Ankara region, it was reported that pollen sensitization was the most com-

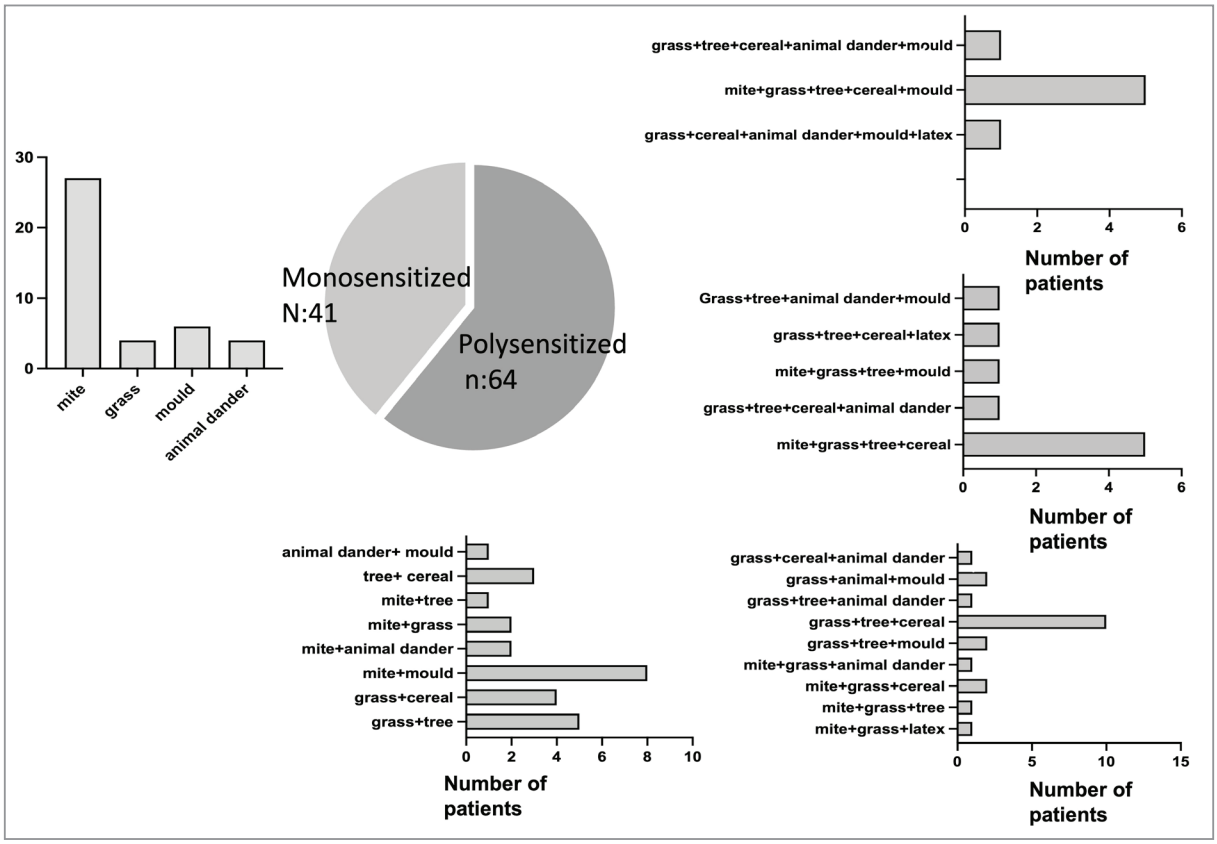

Figure 2. Sensitization profile of the patients with asthma-rhinitis multimorbidity.

mon and house dust mites were the second (23). In another study conducted in İzmir in adults, the most frequent sensitization was to house dust mites (24). The presence of warmer and more humid weather conditions as a result of global warming may have eliminated the regional difference in aeroallergen sensitization, and house dust mites may have become the most common sensitizer (25). As noted in the literature, we could not show an association between HDM sensitivity and asthma control, but in agreement with the literature, we found that HDM-sensitive patients had more severe asthma (26,27). Furthermore, seasonal allergens (grass, tree, cereal pollen) and perennial allergens other than HDMs were not found to be associated with asthma severity or control.

Although generally more than half of NERD patients have at least one aeroallergen sensitization, knowledge about sensitization patterns is limited (28,29). A multicenter study examining aeroallergen sensitization patterns in NP patients from Spain reported that asthma was more frequently associated with allergic patients especially HDM-sensitive, while NSAID hypersensitivity was more common in non-allergic NP patients (30). In our study, we found a higher rate of NSAID hypersensitivity in monosensitized AR, especially in HDM-sensitive patients. In another study of NSAID-sensitive patients, 80% of those who had a skin prick test for common aeroallergens were positive, but most were polysensitized and the most common sensitizer was house dust mites (31). A review study that delved into the relationship between NSAID hypersensitivity and mite allergy reported that NSAID-sensitive patients were often atopic and allergic to mites. They suggested an interesting interaction between HDM allergy and leukotriene synthesis disorders and the COX pathway. They hypothesized a link between atopic genes and the LTC4S gene. They also showed that COX-1 enzyme activity was inhibited by *D. farinae* and *D. pteronyssinus* extracts, respectively (32). Additionally, another study confirmed that NSAID hypersensitivity and HDM allergy are factors associated with severe asthma (33). These results also shed light on our findings. Additional studies are needed to further understand the mechanisms of this process.

Table 3. Characteristics of the monosensitized and polysensitized AR patients

		Monosensitized AR (n= 41), n (%)	Polysensitized AR (n= 64), n (%)	p
Age (mean ± SD)		47.85 ± 12.82	42.55 ± 14.03	0.005
Male/female		10 (24.4)/31 (75.6)	13 (20.3)/51 (79.7)	0.63
NSAID sensitivity		10 (21.4)	6 (9.4)	0.04
Nasal polyposis		12 (29,3)	11 (17.2)	0.15
Chronic sinusitis		8 (19.5)	11 (17.2)	0.79
Bronchiectasis		3 (7.3)	2 (3.1)	0.37
GERD		8 (19.5)	11 (17.2)	0.79
Obesity		11 (26.8)	25 (39.1)	0.46
The onset age of asthma (mean ± SD)		31.82 ± 11.46	29.68 ± 13.04	0.39
Asthma onset	Early-onset	2 (4.9)	14 (21.9)	0.05
	Adult-onset	30 (73.2)	36 (56.3)	
	Late-onset	9 (22)	14 (21.9)	
Asthma phenotype	Eosinophilic	23 (56.1)	29 (45.3)	0.32
	Non-eosinophilic	18 (43.9)	35 (96.9)	
Severity of asthma	Severe	30 (73.2)	32 (51.2)	0.03
Control of asthma	Total	27 (65.9)	45 (70.3)	0.78
	Partial	2 (4.9)	4 (6.3)	
	Uncontrolled	12 (29.3)	15 (23.4)	
ACT (mean ± SD)		22.32 ± 3.5	22.78 ± 3.2	0.49
Number of asthma attacks (mean ± SD)		0.39 ± 0.62	0.28 ± 0.60	0.38
Pulmonary function tests (mean ± SD)	FEV_1 %	77.35 ± 22.17	86.34 ± 18.24	0.03
	FEV_1 mL	2.04 ± 0.83	2.42 ± 0.84	0.02
	FEV_1/FVC	77.90 ± 11.71	77.64 ± 9.9	0.009

Limitations

Our study has some limitations. First of all, the fact that our study was conducted in a tertiary university hospital, may create a selection bias and make it difficult to attribute the results to the general population. On the other hand, local allergic patients are likely to be found among patients with negative allergy test results and classified as nonatopic rhinitis. However, these patients could not be differentiated because nasal provocation tests could not be performed. Finally, we were unable to distinguish cross-sensitive patients between grass- and cereal-sensitive patients as we were unable to perform component-resolved analysis.

CONCLUSION

In conclusion, patients with asthma-rhinitis multimorbidity often include polysensitized patients. House dust mites were the most common sensitizers in both monosensitized and polysensitized patients. The co-existence of NAR increased with increasing age in asthmatic patients.

Ethical Committee Approval: This study approval was obtained from Ankara University Human Research Ethics Committee (Decision No: İ05-253-22, Date: 27.04.2022).

CONFLICT of INTEREST

The authors have no conflicts of interest to declare for this study.

AUTHORSHIP CONTRIBUTIONS

Concept/Design: DM, ZÇS, YSD

Analysis/Interpretation: ZÇS, BÖÖ

Data acqusition: BÖÖ, ZÇS

Writing: All of authors

Clinical Revision: DM, ZÇS, YSD

Final Approval: All of authors

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