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Prevalence and Severity of COVID-19 among Pediatric Patients with Atopy: A Cross-sectional Study in Kerman, Southeast Iran

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ABSTRACT

The tragic COVID-19 pandemic affected many children worldwide. Among the factors that may influence the course of viral infections including COVID-19, it is still uncertain whether atopy has a protective or predisposing role. The study aims to address the knowledge gap by investigating the prevalence and severity of COVID-19 among atopic children in Kerman, in 2022.

A descriptive-analytical cross-sectional study on children with a history of atopy was performed in Kerman Medical University. Demographic information, type of atopy (including allergic rhinitis, Hyper-Reactive Airway Disease (HRAD) or asthma, eczema, urticaria, anaphylaxis, and food allergy), history of COVID-19 infection, and disease severity were recorded.

A total of 1007 children and adolescents, (boys: 56.4%, girls: 43.6%, age: 5.61 ± 2.64 years) were included in the study. History of COVID-19 infection was positive in 53.5%, with 75.9% of the cases exhibiting mild disease severity. The frequency of atopies was HRAD or asthma (67.2%), allergic rhinitis (42.6%), and food allergy (27.4%). The frequency of COVID-19 cases was significantly higher among patients with HRAD or asthma, whereas it was significantly lower among those with food allergies, anaphylaxis, and eczema. Among atopic individuals, COVID-19 severity was significantly lower in those with allergic rhinitis, while the opposite trend was observed among food-allergic individuals.

This study sheds light on the relationship between atopy and COVID-19 among pediatric patients. It seems specific types of atopies may influence the risk and severity of COVID-19 infection differently. A better understanding of these associations can inform clinical management and preventive measures for vulnerable pediatric populations.

Keywords: Allergy and immunology; Clinical decision making; COVID-19

INTRODUCTION

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Coronavirus disease 2019 (COVID-19) emerged as a viral pandemic in Wuhan, China, and swiftly disseminated worldwide in December 2019, becoming

one of the most pervasive and lethal pandemics in history.^{1,2} The disease has affected over 768 million people globally and more than 7.6 million individuals in Iran alone, as reported in published statistics.^{3,4}

Coronaviruses constitute a diverse group of viruses that have led to a spectrum of manifestations, ranging from common colds to severe epidemics like the "Middle East Respiratory Syndrome" and the "Severe Acute Respiratory Syndrome".⁵ COVID-19 is attributed to a novel beta coronavirus called SARS-CoV-2, responsible for hundreds of thousands of fatalities worldwide.⁶

While ongoing research continues to elucidate the exact pathogenesis of the SARS-CoV-2 virus, it has been found that the virus can attack tissues through various mechanisms, including direct tissue invasion and binding to angiotensin-converting enzyme 2 (ACE2) receptors. This interaction stimulates the immune response, releasing inflammatory cytokines and the onset of clinical manifestations of the disease.⁷⁻⁹ From a pathophysiological perspective, atopy is a genetic predisposition to develop a type 2 immune response to environmental antigens. This response relies on some critical cytokines, including interleukin 13.¹⁰

In the assessment of COVID-19 studies, particular emphasis has been placed on identifying risk factors and protective factors associated with the disease. Numerous studies have suggested that factors such as age, gender, race, and various underlying health conditions significantly influence the incidence and severity of COVID-19.¹¹⁻¹³ Among the potential background conditions that are effectively determine the incidence and severity of COVID-19 in children is the presence of atopy and allergic diseases¹¹. Allergic diseases and various types of atopies exhibit a notable prevalence among children.¹⁴ For instance, the prevalence of allergic respiratory diseases, including allergic rhinitis, has been reported to be as high as 40% in children, with this rate showing an upward trend in many countries.¹⁵ In Iran, a study indicated that allergic rhinitis and eczema prevalence in children aged 6-7 years was 15.5% and 7.3%, respectively, with 10.9% showing respiratory symptoms indicative of HRAD or asthma.¹⁶ Other studies reported an average prevalence of 4.4% for HRAD or asthma in adolescents.¹⁷ Furthermore, the prevalence of eczema in school-aged children and adolescents in Iran has been reported to be 4.5%, and allergic rhinitis symptoms around 17.1%.¹⁸

Previous studies have indicated that viral infections may serve as provoking factors for atopic diseases.¹⁹⁻²¹ However, the precise relationship between atopy and susceptibility to contracting a coronavirus infection and the impact of the interaction between this new virus and underlying atopy in patients remains a novel challenge, lacking sufficient evidence.

Initially, it was speculated that patients with chronic respiratory diseases would be at a higher risk of developing severe COVID-19.²² In previous viral pandemics such as H1N1, associations were observed between respiratory diseases, including HRAD or asthma, and greater severity of viral infections^{23,24}. Nevertheless, as research expanded to explore the link between allergic respiratory diseases (including HRAD or asthma and allergic rhinitis) and COVID-19, some studies presented contradictory evidence, suggesting a lower prevalence among COVID-19 patients.^{25,26} In a systematic review, the prevalence of HRAD or asthma in individuals with COVID-19 was found to be 1.6%, lower than the general population prevalence of 4.4%.²⁶

Conversely, other studies have shown that individuals with common allergic diseases, such as rhinitis or atopic dermatitis, did not experience a severe clinical course of COVID-19, highlighting the potential role of type 2 immune regulation in the pathogenesis of COVID-19.²⁷ Furthermore, certain studies have reported associations between allergic rhinitis and eczema with hospitalization rates and length of stay due to COVID-19.²⁸ Additionally, investigations in adults with COVID-19 have revealed a lower prevalence of allergic diseases and HRAD or asthma compared to healthy individuals in the community.²⁹ These findings have led some to postulate that allergies and HRAD or asthma may not serve as predisposing factors for SARS-CoV-2 infection, with some even suggesting atopy could offer protection against COVID-19.³⁰

Presently, several researchers believe that the reduced prevalence of atopy, particularly HRAD or asthma and rhinitis, in COVID-19 patients is associated with lower expression of angiotensin-converting enzyme 2 (ACE2) receptor in the airway epithelium of individuals with these conditions.³¹ Studies indicate that type 2 immune responses and interleukin 13, characteristic of atopy, may contribute to decreased ACE2 receptor expression.³² Additionally, other factors such as increased mucus production and impediment of viral entry into alveolar cells, as well as the use of inhaled corticosteroids, have been suggested as potential mechanisms through which

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HRAD or asthma and rhinitis might confer protection against COVID-19.³³ Nevertheless, the precise nature of this association and its underlying pathophysiological mechanisms remain unclear.

Given the varied and conflicting findings regarding the prevalence of atopy and its potential role in exacerbating or mitigating COVID-19, coupled with limited research in this area, particularly concerning children in the city of Kerman, Iran, this study aims to investigate the frequency and severity of COVID-19 in children with a history of atopy in Kerman City during 2022.

MATERIALS AND METHODS

In this analytical and descriptive cross-sectional study, we aimed to gather information about children with a history of atopy who were referred to the allergy clinics of Kerman University of Medical Sciences and Afzalipour Academic Hospital in Kerman during 2022.

Our case recruitment criteria included children between the ages of 1 month and 15 years with a documented history of atopy either based on clinical records or diagnosed by a pediatrician or allergist. We included all patients referred to the allergy clinics during the specified period. Exclusion criteria involved individuals with known immunodeficiency, diabetes, cardiac, metabolic, or neurological diseases and cases with incomplete or inaccurate records or those unwilling to cooperate with the research team.

Convenient sampling led us to include 1007 patients, and we meticulously recorded all essential data in our project dataset. Some data were obtained through interviews with parents and completing paper forms. Additionally, we extracted relevant information from hospital records, and any discrepancies were rectified through phone calls or by consulting other reliable sources to ensure the accuracy and completeness of our dataset.

In this study, we classified any child with a physician-diagnosed history of allergic rhinitis, Hyperreactive Airway Disease (HRAD), asthma, eczema, urticaria, or food allergy as a patient with atopy. We recorded the specific type of atopy, which could be one or more of the mentioned conditions. Moreover, we recorded data on COVID-19 infection history, hospitalization due to COVID-19, the type of admitted ward, and the severity of illness based on the need for respiratory support.

For data entry and management, we utilized Microsoft Excel 2019. Statistical analysis was

performed using IBM SPSS software version 26 for Windows. Descriptive statistics, such as frequency, percentage, mean, and standard deviation, were employed to characterize the research data. Analytical statistics involved the use of Chi-square and T-Student tests. We considered a P-value of less than 0.05 statistically significant in our analysis.

Ethical Considerations

The present study received ethical approval from the Research Ethics Committee of Kerman University of Medical Sciences under the identification number IR.KMU.AH.REC.1401.114. Throughout the study, utmost care was taken to uphold the confidentiality of all collected data, which was solely utilized for research purposes. The results were disseminated without any reference to the names or identifiable information of the patients involved.

During face-to-face interactions or phone calls, the objectives of the research were transparently explained to the parents, and they were provided with the necessary assurance that all the information requested would be used exclusively for research purposes and would be treated with utmost confidentiality by the researcher.

RESULTS

In this investigation, a group of patients comprising 1007 children and adolescents exhibiting atopic characteristics was assembled to address the defined objectives. Their ages ranged from 9 months to 13 years, with a mean age of 5.61 ± 2.64 years. The median and mode ages were 5 years, with 577 cases falling below this threshold. Neither gender nor the other demographic variables of the recruited patients showed statistical significance even between COVID-19 vs. non-COVID-19 patients, and we preferred not to report this null information ($p > 0.2$).

In this study, the children's medical history and physical examination revealed the presence of at least one of six distinct types of atopies, namely HRAD or Asthma, Allergic Rhinitis, Food Allergy, Urticaria, Anaphylaxis, and Eczema. Notably, most cases presented with a combination of more than one of these atopic conditions, with only three patients displaying four different types simultaneously.

Among these unique cases, one noteworthy instance involved a 10-year-old boy diagnosed with moderate COVID-19. He received outpatient treatment and had a

positive medical history of HRAD or asthma, allergic rhinitis, food allergy, and urticaria. Importantly, the patient did not report a history of using inhalers or receiving invasive respiratory support for COVID-19 treatment.

Furthermore, two other 5-year-old girls demonstrated a positive history of HRAD or asthma, allergic rhinitis, food allergy, and eczema. Remarkably, neither of these girls had experienced a COVID-19 infection.

Table 1 encompasses a comprehensive presentation of the overall descriptive data and analyses pertaining to the various types of atopies exhibited by the other patients.

Based on the data presented in Table 2, 1518 atopic occurrences were recorded. Among these cases, a substantial 90.77% (1378) exhibited at least one of the following conditions: HRAD or Asthma, Allergic Rhinitis, or Food Allergy. Conversely, less than 10% of cases involved other types of atopies, such as eczema, urticaria, and anaphylaxis.

Of all the cases, 57.5% (579) were found to have only one type of allergy, while 42% (423) had a medical history comprising multiple types of atopies.

In light of these findings, Figures 1-a, 1-b and 1-c provide a visual representation and description of the cases with one or more frequently observed types of atopies, even for those with just one type or two or more allergies (Figure 1-a) and also their relationship with COVID-19 infection (Figures 1-b and 1-c). HRAD or Asthma emerged as the most prevalent type, independently and in combination with other atopy types. Additionally, food allergy appeared to be more common among patients who had not contracted COVID-19.

Among the entire cohort of 1007 cases, 539 patients (53.5%) reported a history of COVID-19 infection. The diagnosis of COVID-19 in these 539 cases was determined clinically (49.2%), with a positive PCR test (16.7%), and based on a positive history of close contact

with a known COVID-19 patient (34.1%). For disease severity, 75.9% experienced mild, 11.5% had a moderate presentation, and 12.6% exhibited severe symptoms.

The majority of COVID-19 cases were managed on an outpatient basis (74.6%) who have not been admitted to the hospital, while 125 individuals (23.4%) required admission to the pediatric ward for further care, and a smaller subset comprising 11 patients (2.1%), necessitated intensive care unit (ICU) admission due to the severity of their condition. In 12.7% of the COVID-19 cases, there was evidence of Multiple Inflammatory Syndrome in Children (MIS-C), a condition associated with post-COVID-19 inflammatory responses in some pediatric patients. Additionally, 11.2% of the COVID-19 cases required non-invasive respiratory support without the need for endotracheal intubation.

These findings highlight the distribution of COVID-19 infection and its associated clinical features among the studied groups of children and adolescents with atopy.

The comparison of children with and without COVID-19 in terms of demographic characteristics showed no significant differences in gender, family history, and feeding history during infancy between the two groups. However, children with COVID-19 (N=539, Mean=5.87, SD=2.64) were found to have a significantly higher age compared to non-infected children (N=468, Mean=5.30, SD=2.60) ($p < 0.001$).

In reviewing the simultaneous types of atopies, the analysis showed that 57.5% of children had one type of atopy, while 33.9% presented with two types, and 8.0% concurrently had three types of atopies. Upon classifying the types of atopies by gender, it was observed that HRAD or asthma, allergic rhinitis, food allergy, and urticaria were more prevalent in boys. In contrast anaphylaxis and eczema were more common in girls. However, these differences were not statistically significant ($p > 0.1$) (refer to Table 1).

Table 1. Frequency of six types of atopies in overall by gender

		N	% in Atopy types	% in patients	Boys N (%)	Girls N (%)	
Type of Atopy	HRAD or asthma	1378	675	44.5%	67.2%	388 (57.5)	287 (42.5)
	Allergic Rhinitis		428	28.2%	42.6%	239 (55.8)	189 (44.2)
	Food Allergy		275	18.1%	27.4%	145 (52.7)	130 (47.3)
	Urticaria		48	3.2%	4.8%	33 (68.8)	15 (31.3)
	Anaphylaxis		30	2.0%	3.0%	14 (46.7)	16 (53.3)
	Eczema		62	4.1%	6.2%	29 (46.8)	33 (53.2)
Total			1518	100.0%	151.0%		

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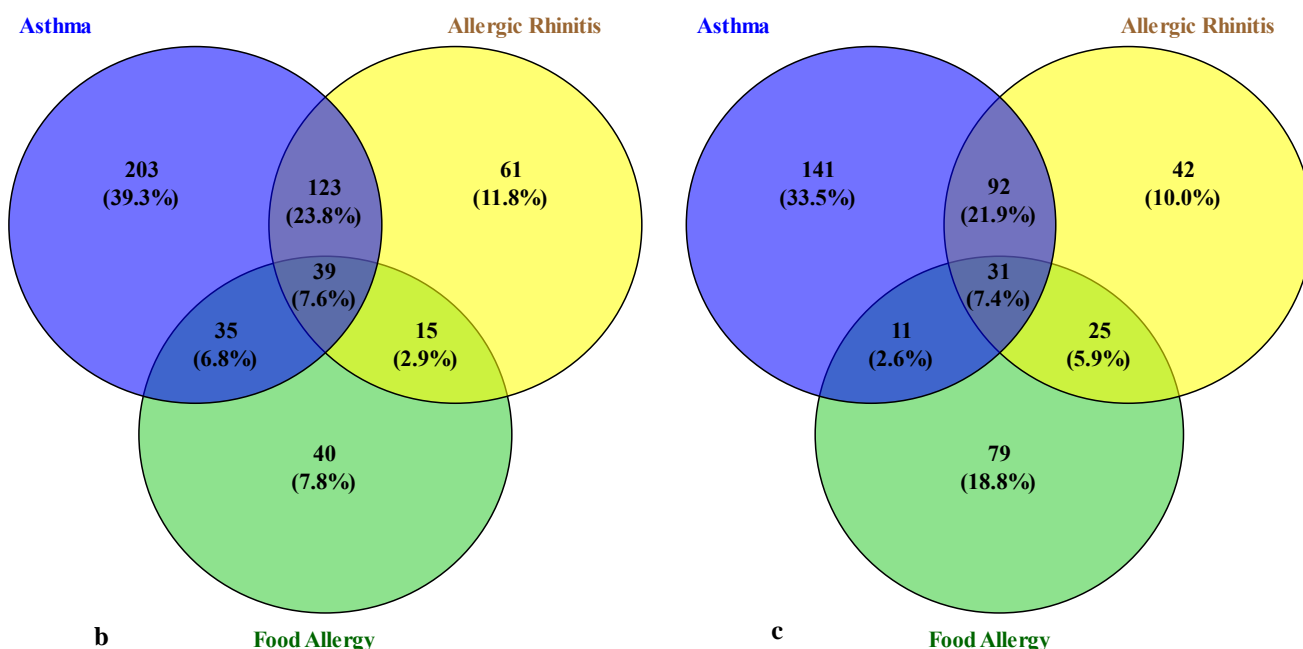
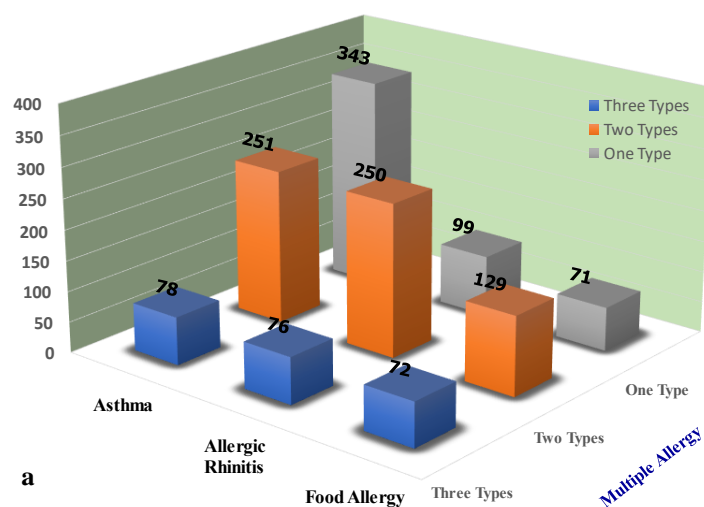


Figure 1. a) Three more frequent types of allergies in all patients with one, two or more types of atopies. b) Venn diagram of allergies in COVID-19 patients representing coincidence of atopies. c) Venn diagram of allergies in non-COVID-19 patients representing coincidence of atopies

The relationship between each type of atopy and the severity of COVID-19 in individuals with a history of the infection was also investigated. Figure 2 illustrates statistically significant differences in the severity of COVID-19 among those with allergic rhinitis and food allergy. Specifically, 84.9% of individuals with allergic rhinitis experienced mild COVID-19, while in individuals without allergic rhinitis, 68.8% of COVID-

19 cases were mild, and a higher percentage of severe cases was observed ($p < 0.001$). Additionally, individuals with food allergies exhibited a higher frequency of severe COVID-19 compared to those without food allergies ($p < 0.05$). No significant relationships were found between asthma, urticaria, anaphylaxis, eczema, or having two or three concurrent types of atopies with the severity of COVID-19 ($p > 0.05$).

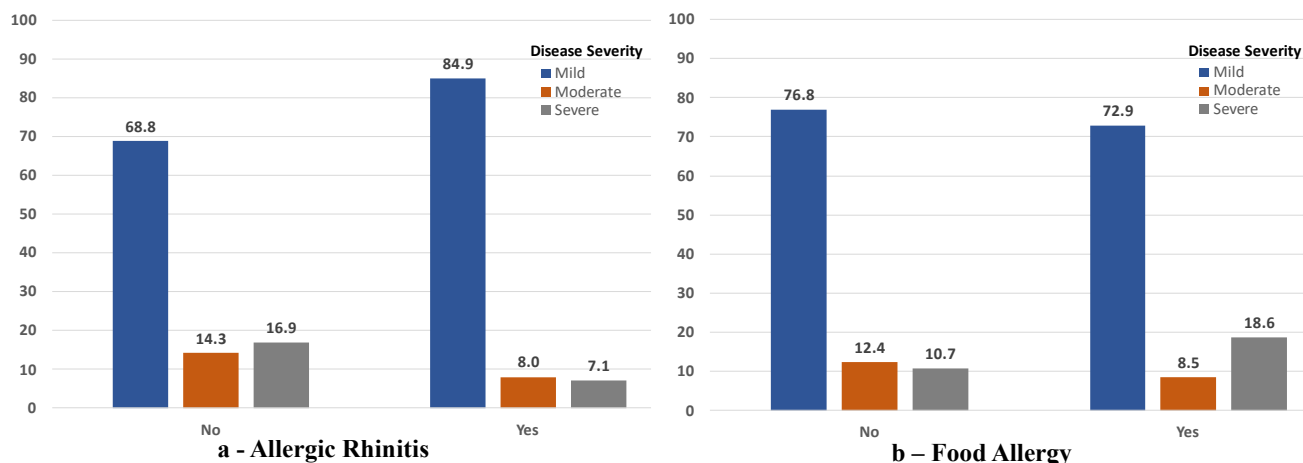


Figure 2. Proportion of two atopics (a- allergic rhinitis, b- food allergy) with severity of COVID-19.

Furthermore, a comparison of the ages of patients in three groups (one, two, or three types of allergies) revealed that the mean age of the first group did not exhibit a statistically significant difference ($p>0.1$). However, this difference was statistically significant in those with two or three types of simultaneous allergies ($p<0.005$) Notably, the mean age of COVID-19 patients was higher than non-COVID-19 patients, and as the number of concurrent types of allergies increased, the age also increased. In other words, children infected with COVID-19 who had two or three types of allergies were older than others (refer to Table 2 and Figure 2-a).

Another significant finding is the relation between the age and the severity of COVID-19 in children with simultaneous types of allergies. As shown in Figure 2b, the mean age in patients who did not have HRAD or

asthma was lower than the others ($p<0.001$). In Table 3 and Figure 3c, it is evident that the severity of COVID-19 is lower in patients who did not have HRAD or asthma ($p<0.001$). The children who have had "Rhinitis & Food Allergy" seem to be protected against the severe type of COVID-19.

Based on the statistical analysis, the rate of COVID-19 infection was higher in patients with HRAD or asthma in both genders. Additionally, the rate of COVID-19 infection was higher for allergic rhinitis in boys however it was lower in boys with food allergy and eczema. Moreover, the rate of COVID-19 infection with anaphylaxis was lower in both genders. The detailed proportions of these relationships are presented in Tables 3a and b.

Table 2 - Comparing the mean age of COVID-19 patient based on simultaneous types of allergies and severity

Simultaneous Types of Allergies	N (%)	COVID-19		Non-COVID-19		p
		Mean (SD) of Age	N (%)	Mean (SD) of Age	N (%)	
One Type	311 (53.7)	5.06 (2.45)	268 (46.3)	4.78 (2.55)	0.173 (ns)	
Two Types	184 (53.8)	6.78 (2.46)	158 (46.2)	5.95 (2.69)	0.003**	
Three Types	42 (51.9)	7.83 (2.50)	39 (48.1)	6.29 (1.59)	0.002**	

Severity of COVID-19	Rhinitis & Food Allergy - N (%)	Asthma & Rhinitis N (%)	Asthma & Food Allergy - N (%)	Asthma & Rhinitis & Food Allergy-N(%)	p
Mild	14 (100)	109 (90.1)	17 (51.4)	31 (81.6)	0.0001**
Moderate	0 (0)	6 (5)	5 (15.2)	3 (7.9)	
Severe	0 (0)	6 (5)	11 (33.3)	4 (10.5)	

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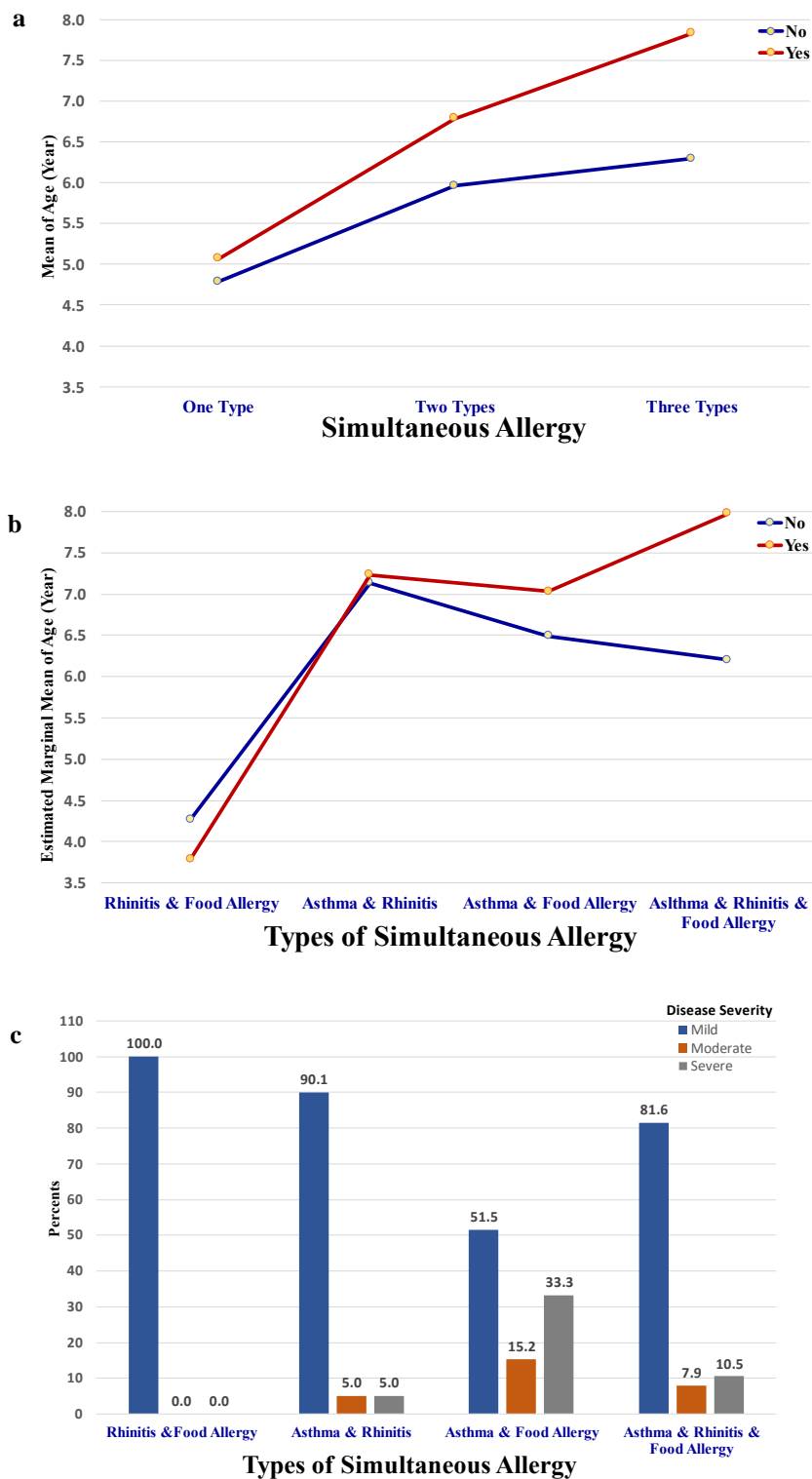


Figure 3. Simultaneous allergy types and mean of age and COVID-19 severity. a) Line diagram for comparing the mean of age in one, two, or three types of allergies for COVID-19 and non-COVID-19 patients. b) Line diagram for comparing the mean of age in common types of simultaneous allergies for COVID-19 and non-COVID-19 patients. c) Bar graph for the severity of COVID-19 in common types of simultaneous allergies

Table 3. Comparing proportion of COVID-19 infection based on atopy type in both genders.

N (%)	Non-COVID-19	COVID-19	Total	p
Male				
HRAD or Asthma	150 (38.7)	238 (61.3)	388	0.001**
Allergic Rhinitis	90 (37.7)	149 (62.3)	239	0.003**
Food Allergy	78 (53.8)	67 (46.2)	145	0.013*
Urticaria	20 (60.6)	13 (39.4)	33	0.062
Anaphylaxis	12 (85.7)	2 (14.3)	14	0.002**
Eczema	21 (72.4)	8 (27.6)	29	0.002**
Female				
HRAD or Asthma	125 (43.6)	162 (56.4)	287	0.004*
Allergic Rhinitis	100 (52.9)	89 (47.1)	189	0.109
Food Allergy	68 (52.3)	62 (47.7)	130	0.303
Urticaria	9 (60.0)	6 (40.0)	15	0.365
Anaphylaxis	15 (93.7)	1 (6.3)	16	0.0001**
Eczema	21 (63.6)	12 (36.4)	33	0.071

** $p < 0.005$ * $p < 0.05$

DISCUSSION

Atopy and allergies are prevalent disorders among children and adolescents. As the COVID-19 pandemic has unfolded globally, there has been increasing interest in understanding the potential link between underlying atopy and the severity of COVID-19 illness. Numerous studies have yielded varying findings regarding the potential protective or exacerbating effects of different atopy types on the course of COVID-19 disease. However, these results have sometimes presented inconsistencies, necessitating further investigation.

This study aimed to explore the frequency of COVID-19 infection and its severity in a population comprising over a thousand children and adolescents with atopy. Our research is one of the few studies to comprehensively assess various common atopy types and their potential association with COVID-19. By shedding light on this relationship, we hope to contribute valuable insights to the scientific understanding of how atopy may influence COVID-19 outcomes in this population.

"The findings of our study showed that the presence of HRAD or asthma had a significant relationship with the incidence of COVID-19. Among children with HRAD or asthma, 59.3% were infected with COVID-19, while this rate was 41.9% in children without HRAD or asthma. Therefore, according to these findings, HRAD or asthma can be a predisposing factor for infecting

COVID-19 in children and adolescents with atopy. However, our study showed that in people infected with COVID-19, HRAD or asthma was not significantly related to the severity of COVID-19 disease, so HRAD or asthma cannot be considered an aggravating factor in COVID-19. However, because of recall bias, we cannot investigate the precise inhaler use habits in our cases (kind of inhaler, time and duration of use, using before or after the disease), so we cannot say HRAD or asthma primarily had an effect or not; because being on treatment or not probably has an effect on the pathophysiology of atopy concerning COVID-19 infection."

Differences in race, environmental factors, and socioeconomic status could be other factors that influence and contribute to conflicting results in various articles. Past experiences with viral pandemics have raised concerns that HRAD or asthma might be a predisposing factor for SARS-CoV-2 infection. However, findings regarding this virus are conflicting. During the influenza A (H1N1) pandemic, several studies demonstrated that patients with asthma were more susceptible to asthma attacks. Asthma was reported to be one of the most common underlying conditions in individuals infected with this virus and a higher incidence of H1N1 virus infection in asthmatic children vs. non-asthmatic children²³ that is consistent with our study findings.³⁴⁻³⁶

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Several studies have been conducted to assess the relationship between HRAD or asthma and COVID-19. Some studies have compared the prevalence of asthma in COVID-19 patients with the prevalence in the general population. The results have been inconsistent, with some studies showing higher prevalence and others reporting lower prevalence. Adir et al. found a wide variation in the distribution of asthma and COVID-19 across different geographical areas in certain studies.³⁷ Regarding asthma and the severity of COVID-19 infection, Choi et al, demonstrated that asthma is not an independent predictor of the prognosis of patients with COVID-19,³⁸ which is in line with the findings of our study. El-Sayed et al, also reported similar findings, indicating that the severity of COVID-19 did not significantly differ between asthmatic and non-asthmatic children.³⁹ However, Schroeder et al, showed that in children with COVID-19, having asthma is a predictive factor for the duration of hospitalization and the need for respiratory support, and it is associated with a worse prognosis.⁴⁰ These conflicting results emphasize the complexity of the relationship between HRAD or asthma and COVID-19 outcomes. Various variables, including geographic location, population characteristics, and the overall healthcare infrastructure, influence the impact of these factors. Further research is needed to gain a deeper understanding of the interactions between HRAD or asthma and COVID-19, considering various confounding factors, to guide clinical management and public health strategies effectively.

On the contrary, Robbins et al, reported that asthmatic children visit the hospital less frequently due to COVID-19, however when they do, they tend to experience a higher disease severity.⁴¹ The differences observed in various studies may be attributed to several reasons, as highlighted by Adir et al, One possible factor is the method used to diagnose HRAD or asthma and COVID-19. Additionally, race can also play a significant role; for instance, African American populations have been found to exhibit higher levels of ACE2 gene expression, which increases their susceptibility to SARS-CoV-2 infection.⁴² Moreover, variations in the prevalence of HRAD or asthma among different countries can be attributed to differences in environmental exposures, socioeconomic status, and genetic predisposition.³⁷ Furthermore, the type of treatment received for asthma may also impact the prognosis of COVID-19. Inhaled corticosteroids, for example, have shown anti-inflammatory effects on the

lungs, leading to reduced expression of ACE-2 and TMPRSS2 in bronchial epithelial cells, as well as inhibiting the replication of SARS-CoV-2.^{37,38,42} Consequently, these medications may influence the severity of COVID-19 disease.

These multifaceted factors collectively contribute to the intricate relationship between HRAD or asthma and COVID-19 outcomes. It underscores the need for comprehensive and well-designed studies that consider the various influencing elements to gain a more comprehensive understanding of the interplay between these factors and the course of COVID-19 disease. This knowledge can inform the development of more effective clinical approaches and public health interventions.

Our study also demonstrated that some children with a history of food allergy, anaphylaxis, and eczema had a lower frequency of COVID-19 illness. Additionally, children with allergic rhinitis experienced a milder course of the COVID-19 disease. Studies examining the relationship between these atopies and COVID-19 are limited. Similar to our findings, Vezir et al. reported that children with allergic rhinitis experienced a milder course of COVID-19.⁴³ Keswani et al, also found that allergic rhinitis and eczema were associated with better outcomes in patients with COVID-19.²⁸ Chhiba et al, reported in another study that rhinosinusitis and allergic rhinitis were associated with a lower risk of hospitalization due to COVID-19.⁴⁴ Beken et al, stated that allergic rhinitis and eczema were not significantly associated with hospitalization due to COVID-19 and are not considered risk factors for COVID-19, although the sample size in that study was low.⁴⁵ Du et al, found in another study that allergic rhinitis and atopic dermatitis were unrelated to SARS-CoV-2 infection²⁹. Additionally, Scala et al. mentioned atopy as a protective factor against COVID-19 in adults, but specific types of atopies were not reported in that study.⁴⁶

We noticed a dual role for food allergy about COVID-19. Our findings showed that food allergy had a protective effect against COVID-19 infection, with 46.9% of people with food allergy being infected, compared to 56.0% of those without food allergy. However, in children with COVID-19, a study of food allergy concerning the severity of COVID-19 showed that more severe cases of COVID-19 were more frequent in children with food allergy. There are few publications on the relationship between food allergy and COVID-19. In two separate studies, Beken et al. and

Du et al., did not observe a significant association between food allergy and COVID-19 infection.^{29,45} Most of the studies on food allergy and its relationship with the COVID-19 pandemic have focused on its psychological effects on parents and the challenges caused by the pandemic in timely diagnosis, evaluation, and prescribing the appropriate diet for these patients.^{47,48} Given the wide range of food allergies and their various mechanisms and the need for more detailed diagnostic investigations, it is evident that more studies are needed to understand better the exact relationship between food allergies and the course of COVID-19 infection and its severity.

The present study investigated the relationship between types of atopies and COVID-19 disease. The findings of the study revealed that more than half of the children with atopy had a history of COVID-19, and most of the cases were mild. Moreover, the study indicated that HRAD or asthma may act as a predisposing factor for contracting COVID-19, but it does not pose a risk for higher severity of the disease. On the other hand, atopies such as allergic rhinitis, eczema, and anaphylaxis were associated with a milder course of the infection or a lower incidence of COVID-19, suggesting a possible protective effect against the disease.

While our study did not involve any specific intervention, we would like to point out one of our significant limitations: the absence of a control group. Despite our best efforts to mitigate potential biases, it is important to acknowledge that the absence of a control group limits our ability to draw robust conclusions.

Due to the limited researches performed on less common types of atopies, we would like to recommend multicentric studies and meta-analyses, to obtain a more accurate understanding of the interaction between atopy and COVID-19 disease.

STATEMENT OF ETHICS

This study is approved by research ethics committee of Afzalipour Hospital-Kerman University of Medical Sciences: (ID: IR.KMU.AH.REC.1401.114)

FUNDING

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CONFLICT OF INTEREST

Nothing to be declared.

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