İSTANBUL UNIVERSITY PRESS

Çocuk Dergisi - Journal of Child 2023;23(3):279-284
DOI: 10.26650/jchild.2023.1353232

ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

# Prevalence of Asthma and Allergic Diseases Among Children in Adıyaman, Türkiye: a Cross-sectional Study

## *Adıyaman İlindeki Çocuklarda Astım ve Allerjik Hastalıkların Prevalansı: Kesitsel Bir Çalışma*

**Velat Çelik[1], Hüseyin Tanrıverdi[2], Fedli Emre Kılıç[3], Tolga Tutal[4]**

[1]Adıyaman University Faculty of Medicine, Department of Pediatric Immunology and Allergy Diseases, Adıyaman, Türkiye
[2]Adıyaman University Faculty of Medicine, Department of Child Health and Diseases, Adıyaman, Türkiye
[3]Adıyaman Training and Research Hospital, Adıyaman, Türkiye
[4]Adıyaman University Faculty of Medicine, Adıyaman, Türkiye

**ORCID ID:** V.Ç. 0000-0002-8893-9420; F.E.K. 0000-0002-0964-5572; H.T. 0000-0003-3208-2445; T.T. 0000-0002-3078-522X

**Citation/Atıf:** Celik V, Tanriverdi H, Kilic FE, Tutal T. Prevalence of asthma and allergic diseases among children in Adıyaman, Türkiye: A cross-sectional study. Çocuk Dergisi - Journal of Child 2023;23(3):279-284. https://doi.org/10.26650/jchild.2023.1353232

**ABSTRACT**

**Objective:** To determine the prevalence and associated risk factors of asthma and allergic diseases in school children and adolescents in Adıyaman, Turkey.
**Material and Methods:** The International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was completed online by parents of 280 children aged 6–7 years and 163 adolescents aged 13–14 years living in Adıyaman. Additional questions were added to the online survey to determine the prevalence of food and drug allergies.
**Results:** The prevalence of allergic diseases in the 6–7 and 13–14 age groups were as follows: 23.2% and 18.4% for asthma, 21.4% and 18.4% for allergic rhinitis, 11.4% and 11% for eczema, 10.4% and 8.6% for food allergy, and 8.6% and 3.7% for drug allergy. In the 6–7-year age group, male sex was associated with asthma and allergic rhinitis; cesarean delivery with drug allergy; and fewer siblings with atopic eczema and drug allergy. In the 13–14-year age group, having pets and more siblings were associated with eczema and food allergy, respectively.
**Conclusion:** This is the first study that demonstrated the prevalence of allergic diseases in Adıyaman province and showed that the overall prevalence of allergic diseases is high in the region.

**Keywords:** asthma, allergic rhinitis, children, drug allergy, eczema, food allergy

**ÖZ**

**Amaç:** Adıyaman'da okul çağındaki çocuk ve ergenlerde astım ve alerjik hastalıkların prevalansını ve ilişkili risk faktörlerini belirlemeyi amaçladık.
**Gereç ve Yöntemler:** Uluslararası Çocukluk Çağı Astım ve Alerji Çalışması (ISAAC) anketi Adıyaman'da yaşayan 6-7 yaş arası 280 çocuğun ebeveynleri ve 13-14 yaş arası 163 adölesanların kendileri tarafından online olarak cevaplandı. Bu online ankete besin alerjisi ve ilaç alerjisi prevelanslarını belirlemeye yönelik ek sorular eklendi.
**Bulgular:** Altı-yedi ve 13-14 yaş gruplarında alerjik hastalık prevalansı sırası ile şu şekilde bulundu: Astım için %23,2 ve %18,4, alerjik rinit için %21,4 ve %18,4, egzama için %11,4 ve %11, besin alerjisi için %10,4 ve %8,6 ve ilaç alerjisi için %8,6 ve %3,7. Altı-yedi yaş grubunda, erkek cinsiyet astım ve alerjik rinit ile; sezaryen doğum ilaç alerjisi ile; daha az kardeş ise atopik egzama ve ilaç alerjisi ile ilişkiliydi. On üç –on dört yaş grubunda evcil hayvan sahibi olmak egzama ile; daha fazla kardeşe sahip olmak besin alerjisi ile ilişkiliydi.
**Sonuçlar:** Adıyaman ilinde alerjik hastalıkların prevalansını gösteren bu ilk çalışmada, bölgede alerjik hastalıkların genel prevalansının yüksek olduğunu gösterdik.

**Anahtar Kelimeler:** alerjik rinit, astım, besin alerjisi, çocuk, egzama, ilaç alerjisi

**Corresponding Author/Sorumlu Yazar:** Velat Çelik **E-mail:** velatcelik@gmail.com
**Submitted/Başvuru:** 31.08.2023 • **Accepted/Kabul:** 21.09.2023 • **Published Online/Online Yayın:** 24.10.2023

## INTRODUCTION

Asthma, allergic rhinitis, and atopic eczema are the most prevalent chronic inflammatory conditions in childhood. These conditions impose a significant global burden in terms of healthcare expenses and morbidity, frequently starting in childhood (1-3). The prevalence of allergic disorders has significantly increased in recent decades, particularly in low- and middle-income countries, where up to 10%–30% of the population suffers from at least one allergic disease (4-6). However, the reasons behind this growth are not entirely established yet, and the global distribution of allergic diseases has a substantial variability (4).

The International Study of Asthma and Allergies in Childhood (ISAAC) was founded to promote epidemiological research on asthma and allergic disease in children by establishing a standardized methodology and by facilitating international collaboration (7). Its aims were to describe the prevalence and severity of asthma, rhinitis, and eczema in children, compare them between centers, obtain baseline measures, and provide a framework for etiological research. The design comprised three phases: Phase 1, assessing the prevalence; Phase 2, investigating possible factors; and Phase 3, assessing trends in the prevalence. More than any other epidemiologic study of asthma, allergic rhinitis, and eczema, the simplicity of the ISAAC methodology and its relatively low cost allowed it to be conducted in most settings worldwide (5).

The studies demonstrated significant variations in the prevalence of allergic diseases, which are apparent not only between different regions and countries but also among different centers within the same country and even within the same city (6). Understanding the prevalence of allergic diseases in a region is crucial for planning health services, implementing preventive measures, and assessing the burden on society and the economy (8). Studies conducted in different regions in Türkiye have determined the prevalence of allergic diseases (8-10). To the best of our knowledge, no previous study has been conducted to determine the prevalence of allergic diseases in children in Adıyaman province.

Adıyaman is situated at the point where the Southeastern Anatolia Region meets the Mediterranean Region to the west. It ranks 32$^{nd}$ in terms of population density among the 82 provinces in Türkiye. Before the Kahramanmaraş earthquake on February 6, 2023, it had a population of approximately 636,580 inhabitants. The climate in Adıyaman is characterized by hot and dry summers and relatively mild winters. In the socioeconomic development ranking across Türkiye, Adıyaman is positioned at the 66th place (11). Before the year 2021, no allergist was practicing in Adıyaman province, and thus, the prevalence of allergic diseases has not been previously investigated. Due to the potential variation of allergic disease prevalence in region to region even within the same province, regional allergic diseases should be investigated.

Therefore, this study aimed to determine the prevalence of asthma, allergic rhinitis, atopic eczema, food allergy, and drug allergy and the associated risk factors in children aged 6–7 years and adolescents aged 13–14 years in Adıyaman province.

## METHODS

### Study design and participants

This cross-sectional study was conducted in adolescents aged 13–14 years and children aged 6–7 years in Adıyaman province, Türkiye, between November 15, 2022, and January 21, 2023. The study involved schoolchildren within the specified age brackets, attending both government and private schools in the Adıyaman province, with authorization granted by the Adıyaman Directorate of National Education. The core ISAAC questionnaires, along with queries concerning physician-diagnosed food and drug allergies, were devised using online Google surveys. The school children were divided into two age groups: 13–14-year-olds (adolescents) who self-completed the questionnaires and 6–7-year-olds (children) whose questionnaires were filled out by their parents.(5) A questionnaire link was distributed to the parents of the 6–7-year-old group and directly to the 13–14-year-olds, who filled out the online queries with the guidance of their respective schoolteachers acting as intermediaries.

In Adıyaman province, a total of 12,822 students were aged 6–7 years (1st grade of the primary school) and 11,620 students were aged 13–14 years (8th grade of the middle school). In a previous study by Ones *et al*.(9), the prevalence of ever wheezing was reported to be 25.3%. A study conducted in Diyarbakır, a province adjacent to Adıyaman, reported that the prevalence of ever wheezing was 22.4% (12). Using these data, the sample size was calculated as 479 with a significance level of 0.05 and a power of 80%using the ClinCalc LLC online sample size calculator (13). Schools in Adıyaman were randomly selected, and teachers were given information about the study and the link to the online survey. However, due to the Kahramanmaraş Earthquake on February 6, 2023, that occurred during data collection, the study had to be terminated early without reaching the intended sample size. The online survey link was provided to approximately 1,250 students or parents. A total of 534 adolescents or parents of children responded to the online survey.

The adapted and validated Turkish version of the ISAAC questionnaire was used to determine the prevalence of asthma, allergic rhinitis, and eczema (7,9,14). Since there is no internationally accepted and validated questionnaire to assess the prevalence of food and drug allergies, the follow additional questions prepared by the authors were included in the questionnaire: “Does your child have physician-diagnosed food allergies?,” “Which foods trigger allergic reactions in your child?,” “Does your child have physician-diagnosed drug allergies?,” and “Which medications induce allergic reactions in your child?.” To identify the potential risk factors, including sex, mode of delivery, timing of birth (preterm or full-term/post-term), number of siblings, passive smoking at home, presence of pets (cats, dogs, birds, fish), and presence of ornamental plants, another questionnaire was prepared to be completed by parents or adolescents.

### Statistical analysis

The IBM SPSS Statistics for Windows V.25.0 (IBM, Armonk, New York, USA) was used for statistical analysis. Continuous variables were presented as median [interquartile range (IQR)], whereas categorical variables were expressed as numbers and percentages. Categorical variables were compared using the appropriate chi-square test (Pearson's, Yates', or Fisher's exact test). The association between physician-diagnosed allergic diseases and the number of siblings was assessed using the Mann–Whitney U test. *P*-values of <0.05 (two-tailed) were considered statistically significant.

Ethics committee approval was received for this study from the local ethics committee of the Adıyaman University (protocol number: 2022/3-7) according to the Helsinki Declaration. Online informed consent was obtained from all participants and their parents. In the online surveys, a concise overview of the study was initially provided. Those willing to provide consent for participation were prompted to select the "I consent" option, and only participants who granted consent were directed to the subsequent questions. In this way, online consent was obtained from all participants. The principles of the Declaration of Helsinki were followed in this study.

## RESULTS

### Study participation

A total of 534 individuals responded to the survey questions. Among them, 17 children were aged <6, 61 children were within the 8–12 age group, and 5 children were older than 15 years, who were consequently being excluded from the study. Data collected from 280 children aged 6–7 years and 163 children aged 13–14 years were included in our study. Among the 6–7 age group, 142 (50.7%) were girls, while among the 13–14 age group, 94 (57.7%) were girls.

### Prevalence of allergic diseases

Table 1 shows the prevalence of allergic diseases among the participants. The prevalence of asthma was 23.2% and 18.4% in 6–7- and 13–14-year-old children, respectively. Approximately 48.6% and 33.1% of 6–7- and 13–14-year-olds, respectively, had ever experienced wheezing. The prevalence of allergic rhinitis was 21.4% and 18.4%, and that of eczema was 11.4% and 11% in 6–7- and 13–14-year-olds, respectively. The prevalence of food allergy was 10.4% and 8.6%, and that of drug allergy was 8.6% and 3.7% in 6–7- and 13–14-year-olds, respectively. Parents of children aged 6–7 years were more likely to report all symptoms of allergic diseases compared to adolescents. (Table 1).

### Associated factors

Factors associated with allergic diseases are presented in Table 2 for the 6–7 age group and in Table 3 for the 13–14 age group. In the 6–7 age group, children with physician-diagnosed asthma and allergic rhinitis exhibited a statistically higher male ratio. Furthermore, within this age group, children with physician-diagnosed drug allergies had a higher rate of cesarean section (CS) births. In the 6–7-year age group, children with physician-diagnosed atopic eczema and drug allergy had a higher number of siblings compared to the groups without atopic eczema and drug allergy (Table 2). In the 13–14 age group, adolescents with physician-diagnosed atopic eczema had a higher presence of pets in their homes, and the number of siblings was higher among adolescents with a physician-diagnosed food allergy than those without food allergy (Table 3). No statistically significant differences in terms of other risk factors were observed among the groups.

## DISCUSSION

Our study, which was conducted in Adıyaman province and aimed at determining the prevalence of asthma and allergic diseases in children and adolescents for the first time, as well as the risk factors associated with the prevalence, yielded important results. The study revealed high prevalence rates of asthma, allergic rhinitis, atopic eczema, food allergy, and drug allergy in Adıyaman province. Among children and adolescents included in our study, asthma was the most frequently reported allergic disease. In the 6–7-year age group, male sex was found to be associated with physician-diagnosed asthma and allergic rhinitis; cesarean delivery with drug allergy; and having fewer siblings with atopic eczema and drug allergy. In the 13–14 age group, the presence of pets at home was associated with atopic eczema and having more siblings was associated with food allergy.

Mallol *et al.* (6) conducted a global synthesis of ISAAC studies conducted worldwide. They reported that the global prevalence of asthma, allergic rhinitis, and eczema in the 13–14-year age group was 14.1% (5.4%–23.3%), 14.6% (7.7%–20.6%), and 7.3% (3.2%–13.7%), respectively. In the 6–7-year age group, the prevalence of asthma, allergic rhinitis, and eczema was 11.7% (6.1%–24.3%), 8.5% (3.8%–13.1%), and 7.9% (3%–17%), respectively (6). Studies conducted in Türkiye reported that the prevalence of asthma, allergic rhinitis, and eczema in children aged 6–7 years ranged from 3.6% to 17.3%, 3.4% to 9.5%, and 2.3% to 7.3%, respectively (8,15-17). Among adolescents aged 13–14 years in Türkiye, the prevalence rates of asthma, allergic rhinitis, and eczema ranged from 1% to 12.9%, 2.9% to 8.7%, and 2.7% to 2.8%, respectively.(16,18,19) Some prevalence studies of allergic diseases in Türkiye also used the ISAAC questionnaire in children between the ages of 6 and 18 years, without specifically distinguishing between the 6–7 and 13–14 age groups. In these studies, the prevalence of asthma, allergic rhinitis, and eczema was found to be 1.8%–17.8%, 7.9%–43.2%, and 2.1%–10.7%, respectively (9,10,12,20-24). The prevalence of allergic diseases tended to be higher in more recent studies. In our study, the prevalence rates of asthma, allergic rhinitis, and eczema was higher than that of these previous studies. Several previous studies were conducted more than a decade ago, and the continued increase in allergic diseases over time may explain the increased prevalence found in our results. Studies clearly demonstrate that the prevalence of allergic diseases can be very high in populations with low

socioeconomic status (6). The relatively lower socioeconomic status of Adıyaman province compared to other provinces in Türkiye could be one of the contributing factors to the observed high prevalence of allergic diseases. In addition, several environmental factors, including geography, climate, diet, and exposure to environmental allergens, have been shown to be associated with the prevalence of allergic diseases and may contribute to the observed differences (4,21).

Food allergy is commonly observed in children under the age of 4 years, and therefore they are often excluded from prevalence studies in school-aged children (20). The prevalence of self-reported food allergy varies from 3% to 35% in the general population. However, the prevalence of confirmed FA determined by oral food challenge tests is observed between 1% and 4% (25). Orhan *et al.* (26) conducted a study on 2,739 school children aged 6–9 years in the Eastern Black Sea Region of Türkiye. They reported that the prevalence of parent-reported food allergy was 5.7%. To confirm food allergy, oral food challenge tests were performed, and they found that the prevalence of IgE-mediated food allergy was actually 0.80%. This study showed that the confirmed prevalence of food allergy was significantly lower than the self-reported prevalence of food allergy. A survey study in Türkiye showed a physician-diagnosed prevalence of food allergy of 6.5% in children aged 11–12 years (20). In our study, we found a higher prevalence of self-reported physician-diagnosed food allergy. However, as shown in previous studies, a much lower prevalence can be found when detailed tests such as the oral provocation test are used (27).

In epidemiological cross-sectional studies conducted on children using the questionnaire-based method, the prevalence of drug allergies has been reported between 2.8% and 11.8% (28,29). However, when these patients were further evaluated with detailed tests, evidence of drug allergy was found in 1% to 5% of cases (29). Limited information is available on the prevalence of drug allergy and drug reactions in Turkish children. A survey of 10,096 parents was conducted to assess the prevalence of drug allergy in Turkish children. The rate of immediate-type drug hypersensitivity reported by parents was 7.87%. However, a telephone survey revealed a clinical history suggestive of drug allergy in only 1.16% of the children. Subsequent comprehensive diagnostic evaluation revealed that the true incidence of immediate-type drug hypersensitivity was 0.11% (28). Parents often exaggerate their children's drug allergies, leading doctors to prescribe alternative medications to prevent severe reactions. However, these medications are often more expensive, are less effective, and have more side effects. The high prevalence rates demonstrated in our study support the need for a comprehensive diagnostic evaluation to confirm a suspected drug allergy in a child (28).

Epidemiologic studies have shown that the male sex is a risk factor for asthma and allergic rhinitis in children, with the prevalence of asthma being twice as high in males than in females (9,30,31). In our study, we found an association between asthma and allergic rhinitis and male sex in the 6–7-year age group, but this association was not observed in adolescents aged 13–14 years. With increasing age, however, the gender difference decreases. Before the age of 14 years, males have been shown to have narrower airways relative to the lung size and the higher airway resistance than females. This anatomical variance in the airway structure and hormonal factors may contribute to increased wheezing and lower respiratory rates in males (9,32). In our study, a lower number of siblings was associated with atopic eczema and drug allergy in the 6–7-year age group. This finding could be explained by the hygiene hypothesis, which suggests that having older siblings increases microbial exposure and consequently leads to a lower prevalence of allergic diseases (33, 34). In the 13–14-year age group, a higher number of siblings was associated with food allergy in adolescents. However, we were unable to provide an explanation for this finding. In the 13–14-year age group, the presence of pets was found to be associated with atopic eczema in adolescents. These children are possibly sensitive to pet dander, which may contribute to the persistence of eczema in this group. An association between drug allergy and cesarean delivery in the 6–7-year old group of children. The literature does not provide information on the relationship between CS delivery and the development of drug allergy in children. Cesarean delivery may result in the maternal use of antibiotics, which could lead to early exposure and sensitization of the infant to antibiotics through intrauterine exposure or breastfeeding. This sensitization could potentially contribute to the development of drug allergies later in life.

The main strength of the study is that it first attempts to determine the prevalence of allergic diseases in children and adolescent population in Adıyaman province. Another noteworthy aspect of our study is its timing, as it was completed just before the February 6, 2023, earthquake in Kahramanmaraş. Following the earthquake, an increase in the prevalence of atopic dermatitis and asthma and a worsening of asthma control were observed (35,36). Since our data corresponds to a period before the earthquake, it can serve as preliminary data for future studies investigating the impact of earthquakes on allergic diseases in Türkiye.

The diagnosis of allergic diseases is a global research challenge due to the lack of a universally accepted gold standard. However, the ISAAC diagnostic approach is limited because it relies on self-reported symptom definitions for allergic diseases. In addition, the ISAAC questionnaire may be influenced by a recall bias. Another limitation is that nonstandardized questions were used to determine the prevalence of food and drug allergies. Moreover, objective data, such as results from physical examinations or allergy screening tests, were not available. Furthermore, due to the earthquake in Kahramanmaraş on February 6, 2023, the intended sample size was not reached.

## CONCLUSIONS

We have shown that allergic diseases have a high prevalence in Adıyaman province. However, challenges remain in the accurate

diagnosis and treatment of allergic diseases, which represent a significant public health burden. Thus, it is essential for health policymakers and practitioners to adapt health services to meet the specific needs in this area.

**ACKNOWLEDGMENTS**

We would like to thank Ramazan Aşçı, the Director of Adıyaman Provincial Directorate of National Education, for giving us permission to conduct our study in the schools of Adıyaman. In addition, we would like to thank teacher Mehmet Demir for his help in distributing the questionnaires in the schools.

---

**Ethics Committee Approval:** This study was approved by the ethics committee of the local ethics committee of the Adıyaman University (protocol number: 2022/3-7) according to the Helsinki Declaration.

**Informed Consent:** Legal custodian's assent of the children participated in the research was obtained.

**Peer Review:** Externally peer-reviewed.

**Author Contributions:** Conception/Design of Study- V.Ç., H.T.; Data Acquisition- V.Ç., H.T., F.E.K., T.T.; Data Analysis/Interpretation- V.Ç.; Drafting Manuscript- V.Ç., F.E.K.; Critical Revision of Manuscript- V.Ç., H.T., T.T.; Final Approval and Accountability- V.Ç., H.T., F.E.K., T.T.

**Conflict of Interest:** Authors declared no conflict of interest.

**Financial Disclosure:** Authors declared no financial support.

---

**Etik Komite Onayı:** Bu çalışma Helsinki Bildirgesi'ne göre Adıyaman Üniversitesi yerel etik kurulu etik kurulu tarafından (protokol numarası: 2022/3-7) onaylandı.

**Bilgilendirilmiş Onam:** Araştırmaya katılan çocukların yasal vasisinin onayı alınmıştır.

**Hakem Değerlendirmesi:** Dış bağımsız.

**Yazar Katkıları:** Çalışma Konsepti/Tasarım- V.Ç., H.T.; Veri Toplama- V.Ç., H.T., F.E.K., T.T.; Veri Analizi/Yorumlama-V.Ç.; Yazı Taslağı- V.Ç., F.E.K.; İçeriğin Eleştirel İncelemesi- V.Ç., H.T., T.T.; Son Onay ve Sorumluluk- V.Ç., H.T., F.E.K., T.T.

**Çıkar Çatışması:** Yazarlar çıkar çatışması beyan etmemişlerdir.

**Finansal Destek:** Yazarlar finansal destek beyan etmemişlerdir.

**REFERENCES**

1. Schuler Iv CF, Montejo JM. Allergic Rhinitis in Children and Adolescents. *Pediatr Clin North Am* 2019; 66 5:981-93.
2. Global Strategy for Asthma Management and Prevention. Global Initiative for Asthma; 2023
3. Langan SM, Irvine AD, Weidinger S. Atopic dermatitis. *Lancet* 2020; 396 10247:345-60.
4. Moreno-Lopez S, Perez-Herrera LC, Penaranda D, Hernandez DC, Garcia E, Penaranda A. Prevalence and associated factors of allergic diseases in school children and adolescents aged 6-7 and 13-14 years from two rural areas in Colombia. *Allergol Immunopathol (Madr)* 2021; 49 3:153-61.
5. Asher MI, Garcia-Marcos L, Pearce NE, Strachan DP. Trends in worldwide asthma prevalence. *Eur Respir J* 2020; 56 6.
6. Mallol J, Crane J, von Mutius E, Odhiambo J, Keil U, Stewart A, et al. The International Study of Asthma and Allergies in Childhood (ISAAC) Phase Three: a global synthesis. *Allergol Immunopathol (Madr)* 2013; 41 2:73-85.
7. Asher MI, Keil U, Anderson HR, Beasley R, Crane J, Martinez F, et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. *Eur Respir J* 1995; 8 3:483-91.
8. Topal E KF, Türker K, Kutlutürk K, Gözükara Bağ H. The prevalence of allergic diseases and associated risk factors in the 6–7 age children who are living in Malatya, Türkiye. *Asthma Allergy Immunol* 2017; 15:129-34.
9. Ones U, Akcay A, Tamay Z, Guler N, Zencir M. Rising trend of asthma prevalence among Turkish schoolchildren (ISAAC phases I and III). *Allergy* 2006; 61 12:1448-53.
10. Yazar B, Meydanlioglu A. The prevalence and associated factors of asthma, allergic rhinitis, and eczema in Turkish children and adolescents. *Pediatr Pulmonol* 2022; 57 10:2491-501.
11. Acar S. BKL, Meydan MC., Işık M. İLLERİN VE BÖLGELERİN SOSYO-EKONOMİK GELİŞMİŞLİK SIRALAMASI ARAŞTIRMASI SEGE-2017. T.C. Sanayi ve Teknoloji Bakanlığı Kalkınma Ajansları Genel Müdürlüğü; 2017
12. Ece A, Ceylan A, Saraclar Y, Saka G, Gurkan F, Haspolat K. Prevalence of asthma and other allergic disorders among schoolchildren in Diyarbakir, Turkey. *Turk J Pediatr* 2001; 43 4:286-92.
13. https://clincalc.com/stats/samplesize.aspx
14. Beken B, Ozturk GK, Aygun FD, Aydogmus C, Akar HH. Asthma and allergic diseases are not risk factors for hospitalization in children with coronavirus disease 2019. *Ann Allergy Asthma Immunol* 2021; 126 5:569-75.
15. Tamay Z, Akcay A, Ergin A, Guler N. Prevalence of allergic rhinitis and risk factors in 6- to 7-yearold children in Istanbul, Turkey. *Turk J Pediatr* 2014; 56 1:31-40.
16. Anlar FY, Sancak R, Ozturk F. Childhood allergic disorders in Samsun, Turkey: discrepancy between reported and diagnosed. *Pediatr Allergy Immunol* 2006; 17 8:635-8.
17. Akcay A. TZ, Dağdeviren E., Zencir M., Ones U., Guler N. Denizli'deki 6-7 yas okul çocuklarında allerjik hastalıklarının prevalansları. *Ege Journal of Medicine* 2007; 46(3):145-50.
18. Duksal F, Becerir T, Ergin A, Akcay A, Guler N. The prevalence of asthma diagnosis and symptoms is still increasing in early adolescents in Turkey. *Allergol Int* 2014; 63 2:189-97.
19. Zeyrek CD, Zeyrek F, Sevinc E, Demir E. Prevalence of asthma and allergic diseases in Sanliurfa, Turkey, and the relation to environmental and socioeconomic factors: is the hygiene hypothesis enough? *J Investig Allergol Clin Immunol* 2006; 16 5:290-5.
20. Baccioglu A, Sogut A, Kilic O, Beyhun E. The Prevalence of Allergic Diseases and Associated Risk Factors in School-Age Children and Adults in Erzurum, Turkey. *Turk Thorac J* 2015; 16 2:68-72.

21. Civelek E, Cakir B, Boz AB, Yuksel H, Orhan F, Uner A, et al. Extent and burden of allergic diseases in elementary schoolchildren: a national multicenter study. *J Investig Allergol Clin Immunol* 2010; 20 4:280-8.
22. Tamay Z, Akcay A, Ones U, Guler N, Kilic G, Zencir M. Prevalence and risk factors for allergic rhinitis in primary school children. *Int J Pediatr Otorhinolaryngol* 2007; 71 3:463-71.
23. Guner SN, Gokturk B, Kilic M, Ozkiraz S. The prevalences of allergic diseases in rural and urban areas are similar. *Allergol Immunopathol (Madr)* 2011; 39 3:140-4.
24. Karaman O, Turgut CS, Uzuner N, Olmez D, Babayigit A, Kose S, et al. The determination of asthma, rhinitis, eczema, and atopy prevalence in 9- to 11-year-old children in the city of Izmir. *Allergy Asthma Proc* 2006; 27 4:319-24.
25. Mills EN, Mackie AR, Burney P, Beyer K, Frewer L, Madsen C, et al. The prevalence, cost and basis of food allergy across Europe. *Allergy* 2007; 62 7:717-22.
26. Orhan F, Karakas T, Cakir M, Aksoy A, Baki A, Gedik Y. Prevalence of immunoglobulin E-mediated food allergy in 6-9-year-old urban schoolchildren in the eastern Black Sea region of Turkey. *Clin Exp Allergy* 2009; 39 7:1027-35.
27. Venter C, Pereira B, Voigt K, Grundy J, Clayton CB, Higgins B, et al. Prevalence and cumulative incidence of food hypersensitivity in the first 3 years of life. *Allergy* 2008; 63 3:354-9.
28. Erkocoglu M, Kaya A, Civelek E, Ozcan C, Cakir B, Akan A, et al. Prevalence of confirmed immediate type drug hypersensitivity reactions among school children. *Pediatr Allergy Immunol* 2013; 24 2:160-7.
29. Yazıcıoğlu M, Gökmirza Özdemir P. Epidemiyoloji, sınıflandırma ve mekanizmalar. Ankara: *Türkiye Klinikleri*, 2021: 1-7.
30. Sultesz M, Horvath A, Molnar D, Katona G, Mezei G, Hirschberg A, et al. Prevalence of allergic rhinitis, related comorbidities and risk factors in schoolchildren. *Allergy Asthma Clin Immunol* 2020; 16 1:98.
31. Horwood LJ, Fergusson DM, Shannon FT. Social and familial factors in the development of early childhood asthma. *Pediatrics* 1985; 75 5:859-68.
32. Ren J, Xu J, Zhang P, Bao Y. Prevalence and Risk Factors of Asthma in Preschool Children in Shanghai, China: A Cross-Sectional Study. *Front Pediatr* 2021; 9:793452.
33. Blazquez AB, Berin MC. Microbiome and food allergy. *Transl Res* 2017; 179:199-203.
34. Benn CS, Melbye M, Wohlfahrt J, Bjorksten B, Aaby P. Cohort study of sibling effect, infectious diseases, and risk of atopic dermatitis during first 18 months of life. *BMJ* 2004; 328 7450:1223.
35. Miyashita M, Kikuya M, Yamanaka C, Ishikuro M, Obara T, Sato Y, et al. Eczema and Asthma Symptoms among Schoolchildren in Coastal and Inland Areas after the 2011 Great East Japan Earthquake: The ToMMo Child Health Study. *Tohoku J Exp Med* 2015; 237 4:297-305.
36. Ishikuro M, Matsubara H, Kikuya M, Obara T, Sato Y, Metoki H, et al. Disease prevalence among nursery school children after the Great East Japan earthquake. *BMJ Glob Health* 2017; 2 2:e000127.