ORIGINAL INVESTIGATION

The Prevalence of Allergic Diseases and Associated Risk Factors in School-Age Children and Adults in Erzurum, Turkey

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Abstract

OBJECTIVES: Allergic diseases are a major public health problem, owing to their socioeconomic burden and high frequency. The aim of this study was to assess the prevalence and risk factors of allergic diseases in adults and children in the province of Erzurum.

MATERIAL AND METHODS: Primary school students aged 11-12 years old filled out the International Study of Asthma and Allergies in Childhood (ISAAC) phase II questionnaire, and their parents filled out the European Community Respiratory Health Survey (ECRHS) questionnaire by themselves. We enrolled 494 questionnaires for ISAAC and 946 for ECRHS.

RESULTS: The survey response rates were 91.8% for ISAAC and 87% for ECRHS. The frequencies of doctor-diagnosed asthma, allergic rhinitis, conjunctivitis, atopic dermatitis, and food allergy in children were 11.9%, 8.9%, 27.3%, 3.6%, and 6.5%, respectively. In adults, the rates of wheezing in the chest, accompanying shortness of breath, and wheezing in the absence of flu within the last 12 months were 8%, 8%, and 5.5%, respectively, whereas the rate of asthma attack in the last 12 months was 2.9%, the rate of asthma medication usage was 2.6%, and the frequency of allergic rhinitis was 1.6%. The determined risk factors for childhood were "duration of attending a nursery" for asthma ($p=0.02$, OR=2.51, 95% CI=1.14-5.53), "having ever been to a nursery" for atopic dermatitis ($p=0.02$, OR=3.83, 95% CI=1.24-11.8), and "a family history of rhinitis" for food allergy ($p=0.01$, OR=2.94, 95% CI=1.13-6.57).

CONCLUSION: The prevalence of allergic diseases in children and adults in Erzurum was found to be lower than in studies conducted throughout Turkey and in western regions of the Country. Going to a nursery, the length of nursery education, and a family history of rhinitis were identified as the risk factors for allergic diseases in children. The identification of regional risk factors and taking preventive measures in this regard may provide a reduction in the incidence of allergic diseases.

KEYWORDS: Allergic rhinitis, asthma, dermatitis, Erzurum, prevalence

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INTRODUCTION

Allergic diseases are an important public health problem, owing to their high frequency and socioeconomic burden [1]. These disorders, the etiology of which is unknown exactly, develop in association with many factors, such as environmental and genetic factors. Therefore, they differ depending on the region [2]. The incidence of these diseases is usually lower in underdeveloped regions but higher in industrialized countries [3]. Environmental factors, such as increased industrialization, air pollution, childhood infections, tobacco smoke, feeding habits, and allergens, affect the prevalence of asthma [4,5].

The prevalence of allergic diseases is determined using previously standardized questionnaires and/or accompanying objective markers (like respiratory function test and allergy test), including the International Study of Asthma and Allergies in Childhood (ISAAC) and European Community Respiratory Health Survey (ECRHS) [6,7]. The ISAAC study comprises three phases. The aim of Phase One is to identify the prevalence and severity of asthma in children. Phase Two aims to explore possible etiologic factors. Phase Three is carried out to evaluate the change in prevalence, as a reiteration of Phase One [2,6]. In the research that has been conducted in the last decade, it has been reported that the increase in asthma and allergic diseases has stopped, and in some regions, it has even reversed [8-12].

Repetition of prevalence studies periodically will help to observe whether there is a decrease or increase or not, and it will also provide information on the precautions to be taken. The aim of this study was to assess the prevalence of allergic diseases and associated symptoms and to identify the risk factors affecting the development of these diseases in adults and children in the province of Erzurum, East Turkey.

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Table 1. The prevalence of allergic diseases and their symptoms in children according to the results of the ISAAC questionnaire

Questionnaire items	n (%)
The prevalence of asthma and its symptoms	
Lifelong wheezing	83 (16.8)
Wheezing in the last 12 months	35 (6.5)
Number of asthma attacks (in the last 12 months)*	2.00±0.80
Doctor-diagnosed asthma	59 (11.9)
Wheezing after exercise in the last 12 months	21 (4.3)
The prevalence of allergic rhinitis and its symptoms	
Lifelong allergic rhinitis	202 (40.9)
Allergic rhinitis in the last 12 months	179 (36.2)
Allergic rhinoconjunctivitis in the last 12 months	135 (27.3)
Doctor-diagnosed allergic rhinitis	44 (8.9)
The prevalence of atopic dermatitis and its symptoms	
Lifelong chronic itchy lesion	47 (9.5)
Chronic itchy lesion in the last 12 months	57 (11.5)
Doctor-diagnosed atopic dermatitis	18 (3.6)
The prevalence of food allergy and its symptoms	
Lifelong food allergy	62 (12.6)
Food allergy in the last 12 months	46 (9.3)
Doctor-diagnosed food allergy	32 (6.5)

*Mean±standard deviation

MATERIAL AND METHODS

This cross-sectional study was conducted between January 2012 and January 2013, after getting approval from the ethics committee of the Faculty of Medicine at Atatürk University (2012-36). The list of schools was obtained from the Provincial Directorate for National Education, and random sampling was carried out, regardless of socioeconomic status. The criteria for being included in the study were being a 5th grade student and being a parent of these students. The ISAAC Phase Two questionnaire, which had been translated into Turkish previously and proven for its validity and reliability, and the ECRHS questionnaire were used [13,14]. The educators were explained about the procedure and then given the questionnaire forms by the researchers. After verbal consent of the participants was obtained, the ISAAC questionnaire forms were filled out by the children with their parents, and the ECRHS questionnaire forms were filled out by the parents.

The ISAAC Phase Two Questionnaire consisted of 50 items. In the questionnaire, asthma was defined with the item "Has your child ever had wheezing or whistling in the chest and diagnosed with asthma-bronchitis since he/she was born, in the last 1 year, and during exercise?" Allergic rhinitis was defined with the item "Has your child ever had a problem with sneezing or a runny or blocked nose, when he/she did not have a cold or the flu and diagnosed with hay fever?" Allergic conjunctivitis was defined with the item "Has this nose problem been accompanied by itchy-watery eyes?" Moreover, atopic dermatitis was investigated by asking about the presence of an itchy rash that lasted for at least 6 months and about food allergy by asking about the presence of skin rash, abdominal pain, nau-

sea/vomiting, diarrhea, swelling of the face, and shortness of breath after eating any food. In order to identify the risk factors for atopy, the participants were asked about a family history of allergic diseases, smoking mother, birth weight of the child, breastfeeding, the time of beginning supplementary food, the number of older and younger siblings, attending a nursery, the number of family members living in the same home, the number of rooms at home, having a pet at home and any contact with farm animals, and the presence of humidity and mold at home in the first and last 1 year.

Moreover, the 10-item ECRHS questionnaire investigated gender, wheezing and shortness of breath in the last 12 months, wheezing in the absence of the flu, waking up with tightness of the chest or cough in the last 12 months, having an asthma attack in the last 12 months, use of asthma medication at present, and the symptoms of allergic rhinitis.

Statistical Analysis

Erzurum is the most crowded province in the eastern Anatolia region of Turkey. The population was 398,472 in 2012. The sample size was calculated to be at least 663, with the values of $\alpha=0.05$, $1-\beta=0.80$, $\delta=3\%$, and standard deviation 1%. The reason for the δ value of 3% is that the frequency of atopic dermatitis was found to be 3% in Sivas, which is the nearest city to Erzurum, and it was observed to be the rarest allergic disease [15]. It was anticipated that the sample size would also be adequate for more common diseases, including asthma and allergic rhinitis. While calculating the sample size, the schools providing special education for children with mental disabilities and district/village schools were excluded. Considering the possible presence of students with varying socioeconomic status, the sample size was divided into 3 by means of stratified random sampling, and 14 schools were included, thinking that data would be collected from 2 schools for each level. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS Inc. Chicago, Illinois, USA) 16 for Windows. The results of the ISAAC and ECRHS questionnaires were analyzed separately. Backward multivariate logistic regression analysis was performed, including the risk factors, with a p-value <0.05 in the one-way regression analysis, and odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. OR >1 and p-value <0.05 were evaluated to be risk factors for the disease.

RESULTS

The response rate in the ISAAC questionnaire was 494 out of 538 questionnaire forms and 91.8%. The frequencies of lifelong wheezing, wheezing in the last 12 months, doctor-diagnosed asthma, and wheezing during exercise in children were 16.8 %, 6.5%, 11.9%, and 4.3%, respectively (Table 1). The mean number of asthma attacks in the last 12 months was found to be 2.00±0.80 (at least 1, at most 4). On the other hand, the frequencies of lifelong allergic rhinitis, allergic rhinitis in the last 12 months, doctor-diagnosed allergic rhinitis, and conjunctivitis in the last 12 months were revealed to be 40.9%, 36.2%, 8.9%, and 27.3%, respectively. Incidence rates for lifelong chronic itchy lesion, chronic itchy lesion in the last 12 months, and doctor-diagnosed atopic dermatitis were 9.5%, 11.5% and 3.6%, respectively. Moreover, the frequency rates of patients having a lifelong food allergy, food allergy in the last 12 months, and doctor-diagnosed food allergy were found to be 12.6%,

Figure 1. In children, the rates of the coexistence of rhinoconjunctivitis and asthma, atopic dermatitis and asthma, rhinoconjunctivitis and atopic dermatitis, and all together are 4.6%, 1.6%, 6.7%, and 1.4%, respectively

9.3% and 6.5%, respectively. The incidence rates of rhinoconjunctivitis-asthma, atopic dermatitis-asthma, rhinoconjunctivitis-atopic dermatitis, and all diseases together were determined to be 4.6%, 1.6%, 6.7%, and 1.4% (Figure 1).

The results of the logistic regression analysis that was performed for finding the effects of individual, familial, and environmental risk factors on the development of doctor-diagnosed asthma, allergic rhinitis, atopic dermatitis, and food allergy are presented in Table 2. The risk factors were determined as “duration of attending a nursery” for doctor-diagnosed asthma ($p=0.02$, $OR=2.51$, $95\% CI=1.14-5.53$), “having ever been to a nursery” for atopic dermatitis ($p=0.02$, $OR=3.83$, $95\% CI=1.24-11.8$), and “a family history of rhinitis” for food allergy ($p=0.01$, $OR=2.94$, $95\% CI=1.13-6.57$).

Of the questionnaires, 1076 ECRHS forms were distributed, and 946 of them were returned (Table 3). The response rate was found to be 87%. The rates of female and male patients were 50.6% and 49.4%, respectively. The percentages of wheezing in the chest in the last 12 months, accompanying shortness of breath, and wheezing in the absence of the flu were 8%, 8%, and 5.5%, respectively. On the other hand, the rates of waking up with tightness of the chest, with shortness of breath, and with cough in the last 12 months were 7.1%, 8.7%, and 8.5%, whereas the rates of asthma attack, asthma medication usage, and allergic rhinitis in the last 12 months were 2.9%, 2.6%, and 1.6%, respectively.

DISCUSSION

This study investigated the prevalence of allergic diseases in school-age children through the ISAAC questionnaire and in adults through the ESRHS in the province of Erzurum. In this study, the frequency rates of lifelong wheezing, wheezing in the last 12 years, and doctor-diagnosed asthma in children (16.8%, 6.5%, and 11.9%), which were evaluated by the ISAAC questionnaire, were lower than throughout Turkey (34.5%, 15.8%, and 10.7%) and also than in the western regions (25.8%, 15.9%, and 4.8% in İzmir), except for the rate of doctor-diagnosed asthma [8,9]. In the national prevalence studies conducted with the ECRHS method, the prevalence of wheezing ranges from 16.2% to 22.6%; wheezing accompanied by shortness of breath ranges from 9.2% to 19.2%; wheezing without a cold or the flu ranges from 7.2% to 18.1%; waking up with tightness of the chest ranges from

Table 2. Risk factors for doctor-diagnosed allergic diseases (OR: odds ratio)

	p	OR	95% confidence interval
Risk factors for asthma			
Younger sibling at home	0.39	3.10	0.22-4.11
Duration of attending a nursery	0.02	2.51	1.14-5.53
Contact with animals in the first year of life	0.63	0.44	0.01-12.71
Risk factors for rhinitis			
A family history of asthma	0.98	5.21	0.21-1.17
A family history of rhinitis	0.81	0.23	0.04-1.19
Having ever been to a nursery	0.30	1.33	0.19-0.85
Risk factors for atopic dermatitis			
Having ever been to a nursery	0.02	3.83	1.24-11.8
Presence of food allergy in the child	0.37	0.52	0.12-2.20
A family history of asthma	0.99	1.44	0.19-27.02
A family history of rhinitis	0.07	0.32	0.09-1.10
A family history of atopy	0.78	0.15	0.02-0.95
Risk factors for food allergy			
Younger sibling at home	0.96	0.98	0.43-2.23
Older sibling at home	0.05	2.38	0.99-5.73
A family history of asthma	0.18	0.48	0.16-1.41
A family history of rhinitis	0.01	2.94	1.13-6.57

Table 3. The results of the ECRHS questionnaire showing the prevalence of allergic diseases in adults (n=946)

Questionnaire Items	n (%)
Gender	
Female	479 (50.6)
Male	467 (49.4)
Wheezing in the last 12 months	76 (8)
Accompanying shortness of breath	76 (8)
Wheezing in the absence of the flu	52 (5.5)
Waking up with tightness in the chest in the last 12 months	67 (7.1)
Waking up with shortness of breath in the last 12 months	83 (8.7)
Waking up with cough in the last 12 months	80 (8.5)
Having an asthma attack in the last 12 months	28 (2.9)
Still using asthma medication	25 (2.6)
Allergic rhinitis and its symptoms	15 (1.6)

10.8% to 30.8%; having an asthma attack ranges from 1.6% to 11.8%; and use of medication for asthma ranges from 1.3% to 5.1% [13,16-18]. In comparison with the previous studies, our study revealed that asthma symptoms were less common in adults in Erzurum (8%, 8%, 5.5%, 7.1%, 2.9%, and 2.6%). In adults and children, the prevalence of doctor-diagnosed asthma was similar to that across Turkey, but the prevalence of asthma symptoms was lower, which might have resulted from the positive effect of high altitude on asthma. In recent stud-

ies, it has been suggested that high altitude leads to improvement in the parameters of asthma control test, sinonasal symptoms, 6-minute walk test, blood eosinophil level, serum total IgE, exhaled nitric oxide, respiratory function test, and the need for oral steroids, independent of atopic status. It has been suggested that this can result from the immunomodulatory and anti-inflammatory effects of low air pollution, low amounts of allergens-eg, house dust mite, pollen, and fungal spores-and high ultraviolet light exposure [19,20].

In international studies, it has been suggested that the increase in the prevalence of asthma has been in a plateau phase in recent years, but this increase has continued in developing countries, like our country [11]. For instance, in the years of 1994, 2002, and 2012, the frequencies of wheezing in children in the last 12 years were 3.5%, 9.5%, and 13.1% in the province of Aydın [10]. An increase was seen in the ECRHS results showing the prevalence of asthma in adults in Erzurum both in the last 12 months and at present (2.9% and 2.6%), compared to the results of Mirici et al. [14] in the year 2002 (1.6% and 1.3%). The reasons for the increase in the frequency of asthma were thought to be the sociocultural structure and living conditions changing due to Erzurum's being a migrant-receiving city, as well as being an emigrant city, increasing environmental and air pollution, and decreased childhood infections.

The number of asthma attacks in the last 12 months was found to be 12 on average, and it was accepted to be moderate, since it was less than 4. On the other hand, the frequency of severe attacks was reported to be higher in Van, located in the eastern Anatolia region, than in the western region (30.6% and 2.4%) [8,10]. Different results obtained in the regions having similar climatic conditions can be explained by varying socioeconomic status. For instance, with regard to socioeconomic development, İzmir is ranked first, Erzurum is 59th, and Van is 75th across Turkey [21]. In previous studies, the degree of asthma attack was associated with socioeconomic income level, and the frequency of severe asthma was reported to be as high as 20% in the countries, like India [11].

In our study, lifelong allergic rhinoconjunctivitis, allergic rhinoconjunctivitis in the last 12 months, and doctor-diagnosed allergic rhinoconjunctivitis in children were compared to the rates throughout Turkey and in the western region, and it was found that the frequencies of lifelong rhinitis and rhinitis in the last 12 months were similar, but the frequency of doctor-diagnosed rhinitis was lower [8,9]. Similarly, the frequency of allergic rhinitis in adults (1.6%) was lower than the frequency rate throughout Turkey (8.9-27.7%). This suggests that most of the complaints of rhinitis can be associated with non-allergic causes. While two-thirds of rhinitis cases are actually allergic [8,9,22], about one-fifth of rhinitis cases are allergic in Erzurum, which might be because Erzurum is one of the coldest and highest-altitude cities in Turkey. The lower rate of allergic rhinitis can be explained by the decreased amount of house dust mites and pollen in high altitudes, in addition to the frequent occurrence of respiratory tract infections in cold weather.

In our study, the rate of lifelong eczema in children (9.5%) was similar to that of western regions (9.9%) but lower than the rate across Turkey (17,1%). On the other hand, the

eczema rate in the last 12 months (11.5%) was higher than in both the western regions and across Turkey (8.1% and 7.2%). The rate of doctor-diagnosed eczema (3.6%) was lower than in the western region (4.9%) but higher than throughout Turkey (2.6%). In the world, the frequency of eczema is high in northern European countries and moderate in our country [12]. In Erzurum, eczema is seen more frequently than throughout Turkey, which can be associated with cold and dry weather.

Since food allergy is mostly seen in children aged younger than 4 years old, it is not included in many prevalence studies conducted with school-age children. In the United Kingdom, which is one of the 3 countries where allergy is seen more frequently, the frequency rates of food allergy in children aged younger than 3 years old were found to be 33.7% and 5%-6% for cases reported by parents and confirmed by double-blind oral provocation test [24]. In Turkey, among children aged 6-12 years, the rate of doctor-diagnosed food allergy was reported to be 16% in children with asthma and 7.8% in children not having asthma [25]. In our country, among children aged 6-12 years, the rate of food allergy was reported to be 16% in children with asthma and 7.8% in children not having asthma [25]. Our study found the rates of lifelong food allergy, food allergy in the last 12 months, and doctor-diagnosed food allergy to be 12.6%, 9.3%, and 6.5%, respectively.

In our study, the rate of doctor-diagnosed food allergy was found to be similar to the results of previous studies. Considering that about half of those suffering from food allergy demonstrated real food allergy whereas this ratio decreased to one-fifth after food provocation tests, the results of this study showed the need for allergist in this region.

In the study, the most common allergic disease in children was observed to be rhinoconjunctivitis in this region, whereas asthma symptoms were more frequent than allergic rhinitis in adults. However, the frequency of coexisting allergic diseases in children was similar to that throughout our country [10]. In children, atopic dermatitis was found to be the most common coexisting disease with allergic rhinoconjunctivitis, when analysed with the exclusion of food allergy. On the other hand, most children with asthma had rhinitis. However, the most common coexistence was rhinitis-atopic dermatitis in our study, while it was asthma-rhinitis in other studies [10,14]. But, the prevalence of doctor-diagnosed diseases was lower than the symptoms of allergic diseases, except asthma. This may due to the fact that patients usually ignore allergic symptoms or that both the doctor and patient can be insufficiently aware of an allergic disease. Furthermore, the insufficient number of allergists in the eastern Anatolia region should be remembered.

Considering that allergic diseases can be prevented, identification of regional risk factors becomes even more important. In this study, analyzing the risk factors only for children, the risk factors were determined to be "duration of attending a nursery" for asthma, "having ever been to a nursery" for atopic dermatitis, and "a family history of rhinitis" for food allergy.

In previous studies conducted in our country, a family history of atopy, the structure of the extended family, female gender, age, and living environment were specified to be risk

factors for asthma in adults [8]. On the other hand, the risk factors for allergic rhinitis were found to be a family history of allergy, living in a shanty and humid house, and smoking [5], and for atopic dermatitis, they were a family history of allergy; smoking; living in a shanty, garden, or detached house; having good economic conditions; and a high level of education [8,12]. In our study, that many well-known factors, like a family history of allergic diseases, were found to be insignificant in the risk analysis might have resulted from unreliable responses given to the questionnaire. Moreover, questioning a family history of allergic diseases separately, such as asthma, rhinitis, and eczema, might have led to misperception of this subject by patients with lower socioeconomic status, because questionnaire-based study results are affected by the general culture and health awareness of the sampling group.

In the study, standard questionnaires were used for evaluating the prevalence of allergy, and the results obtained were compared to other studies. However, the different results might have been caused by the different age groups and different times of the prevalence studies conducted throughout Turkey. Moreover, in spite of the standardized questionnaires, the responses given were affected by patients' educational levels and awareness of the disease. Another point to be considered is that by including only school-age children and their parents, younger children and the elderly population were excluded from the study, which is a disadvantage of a cross-sectional study. Including the geriatric population in the study could have led to false high prevalence rates of asthma and allergic rhinitis. This is because some diseases, like non-allergic bronchiectasis, which can be confused with asthma, and chronic sinusitis are seen more often in elderly people than in middle-aged people. Furthermore, the fact that allergic rhinitis and asthma appear mostly between the ages of 7 and 15 years in childhood suggest that our study was conducted with the appropriate age group. However, the lower frequency of food allergy in our study can be related to the disease being encountered in preschool-age children more frequently, and this age group was not included in the study.

In conclusion, with this study, the frequency of allergic diseases in Erzurum was evaluated in adults for the first time and in children for the second time. These data, showing the prevalence of allergic diseases both in children and adults and the risk factors, will help to raise awareness in physicians and to take precautions for health problems.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Atatürk University Faculty of Medicine.

Informed Consent: Verbal informed consent was obtained from participants who participated in this study.

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