

Prevalence of Asthma Symptoms in 13-14-Year-Old Adolescents in Karaj

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ABSTRACT

Asthma is the most common chronic inflammatory respiratory disorder in children. This study was designed to assess the prevalence of asthma in 13-14-year-old adolescents in Karaj, Alborz province in Iran, using the international study of asthma and allergies in childhood (ISAAC) questionnaire.

Totally 950 adolescents attending 40 schools located in 4 regions of Karaj city were enrolled in the survey. The Persian version of the ISAAC questionnaire was filled by 13-14-year-old students. Multi-stage clustered random sampling was used to divide the city of Karaj into four educational districts.

Ever wheezing was reported in 22% of the individuals; 10.52% claimed to have wheeze in the last 12 months and 22.73% had during or after exercise. The experience of wheezing in the last 12 months was more prevalent among males (11.73% vs. 9.38%; $p < 0.05$). However, having a history of asthma was higher among males (7.55% vs. 3.47%; $p < 0.05$). History of hospitalization (60.8%), family history of asthma (49.4%), and history of food allergy (42.3%) were found to be the most frequent characteristics significantly associated with "ever wheezing" ($p < 0.05$).

The prevalence of wheezing in the last 12 months, as a major index of current asthma, was 10% which was close to the national average. However, nocturnal cough and exercise-induced wheezing were higher in Karaj compared to other cities of Iran; which could be related to the high level of air pollution in this industrial area.

Keywords: Asthma; Child; Iran; Prevalence

INTRODUCTION

Asthma is the most common chronic inflammatory

respiratory disorder in children, manifesting by airway hyper-responsiveness and intermittent bronchospasm.¹ Asthma is associated with significant morbidity and

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mortality accounting for the most important preventable emergency room visits, hospitalizations, and deaths.²⁻⁴ Patient-reported or physician confirmed wheeze is primarily considered as asthma.⁴

Asthma has been ranked as the 14th cause of disability.⁵ It is estimated that more than 300 million people have asthma over the globe and more than 400 million people will be asthmatic in near future.^{4,6} The international study of asthma and allergies in childhood (ISAAC) has been acknowledged as one of the most valuable epidemiological surveys which were conducted in three phases; the first phase started in 1991 and the third phase was done in 2001-2003. Asthma, allergic rhino-conjunctivitis, atopic eczema symptoms, and variation in their prevalence during a 5 to 10 years period were assessed in 13-14-year-old adolescents and 6-7-year-old children.⁷ ISAAC phase III showed that the trend of asthma prevalence has changed from being more prevalent in western countries during the last 10 years of the 1900s to the plateau level. On the contrary, its prevalence has increased in developing countries.⁷ Moreover, asthma tends to manifest in more severe forms in poor countries compared to the prosperous ones.⁸

Because many factors including geographic, ethnic, and socioeconomic characteristics impact asthma prevalence,^{4,9} the current study was designed to assess the prevalence of asthma in 13-14-year-old students in Karaj.

MATERIALS AND METHODS

Multi-stage clustered random sampling was used to divide the city of Karaj into four educational districts. Systematic sampling was done based on geographical location to select schools in each of the four districts and some classes were chosen from the previously selected schools. After obtaining necessary permits from the General Education organization of Alborz Province, 40 schools, including public and non-public schools, were randomly selected. Finally, 950 out of 88784 students attending 40 schools located in 4 regions of Karaj city were enrolled in the study. A written parent's consent for participation was signed. The exclusion criteria were the history of symptomatic chronic musculoskeletal disease, cardiopulmonary diseases, any known illness other than asthma that presents with cough, shortness of breath, and wheezing.

The ISAAC questionnaire (Figure 1), used in the

current study, consists of 8 questions about past and present wheezing, the number of wheezing attacks, history of asthma or bronchitis, sleep disturbances due to wheezing, speech limitations during the attacks (i.e. prevents from speaking more than 2 words between breaths), wheezing during or after exercise and persistent dry nocturnal cough. Translation of the questionnaire to the Persian version as well as validity and reliability confirmation was performed after getting permission from World Asthma Network. The ethics committee of the Alborz University of medical sciences approved this study (Code No: IR.ABZUMS.REC.1398.169).

Validity and Reliability of the Questionnaire

A group of professionals focusing on the field was employed to assess each of the questions after the elucidation of the objectives and providing the operational definitions related to the content of the questions.

Face Validity

Every item was assessed on a five-point Likert scale to examine the impact score. The responses were scored as: absolutely important, important, moderately important, slightly important, and not important at all (5-1 points, respectively). The impact scores were calculated; using the following formula:

Impact score = Importance × Frequency (in percent)

All items were higher than the cut-off point of 1.5, considered as the minimum score required to accept the face validity.

Content Validity

A) Content Validity Ratio (CVR), first proposed by Lawshe,¹⁰ assessed based on a three-point Likert scale including necessary, useful but not necessary and unnecessary. Afterward, the CVR was calculated using the following formula:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

n_e : Number of experts who chose the "necessary item"

N: Total number of experts

B) For content validity index (CVI), Waltz and Bausell's method was used, in which experts should rate the "relevance (not relevant, somewhat relevant,

quite relevant, very relevant)", "clarity (not clear, somewhat clear, quite clear, very clear)" and "simplicity (not simple, somewhat simple, quite simple, very simple)" of each item based on a 4-point Likert scale.

$$CVI = \frac{\text{No of professionals scoring items 3 and 4 points}}{\text{Total No of specialists}}$$

Equation 2

The minimum calculated CVI for each item was 0.82 which was more than 0.79, as the minimum acceptable value.

Reliability

To determine test-retest reliability, 20 participants were asked to complete the questionnaire for the second time after 20 days. Then, the calculation of the Spearman-Brown correlation coefficient (0.83) and for internal reliability, Cronbach's α (0.80) were done.

Statistical Analysis

SPSS version 19 was used for statistical analysis. To assess the association between different social and medical factors and asthma symptoms, uni-variable analysis of potential continuous and categorical risk factors was performed using t-test and chi-square, respectively.

Continuous and categorical variables were presented as mean \pm SD and percentages, respectively.

We ran a normality test (i.e. Shapiro-Wilks test) and checked the P-P plot for normality. The null hypothesis was rejected for all the variables; thus, they were normal. A design-based Chi-square was used to assess the association between categorical variables. To reject the null hypothesis, a 2-sided $p < 0.05$ was considered necessary.

RESULTS

A total of 950 adolescents (490 male and 460 females) were enrolled in the study. In terms of wheezing; 22% of the individuals experienced wheezing in their past, 10.52% in the last year, 22.73% during or after exercise. More than 2% of the individuals and approximately 5% of them had speech limitations due to wheezing in the last year. 5.57% of the participants got a positive response to this question: "Have you ever had asthma?" (7.55% male vs. 3.47% female; $p < 0.05$). The prevalence of dry nocturnal cough was 29.57% (Table 1).

Living in a polluted area was significantly related to ever wheezing (42.4%), wheezing in the last year (18.8%), history of wheezing attacks in the last year (10.6% 1-3 times, 4.7% 3-12 times and 3.5% >12 times), nocturnal dry cough (42.4%), sleeping disturbance due to wheezing in the last year (12.9% <1 time, 5.9% ≥ 1 time weekly) and wheezing during exercise (37.6%). A family history of smoking was meaningfully associated with ever wheezing (30.3%),

Table 1. Prevalence of symptoms suspected of asthma among adolescents

Symptoms		Men (N=490)	Women (N=460)
Wheezing(ever)		102 (20.80%)	107 (21%)
Wheezing(in the last 12months)		46 (9.38%)	54 (11.73%) *
Wheezing attacks(in the last 12 months)	None	433 (88.36%)	451 (98.04%)
	1-3 times	38 (7.70%)	45 (9.78%)
	4-12 times	7 (1.40%)	13 (2.82%)
	>12 times	10 (2.00%)	0 (0%)
Sleeping disturbance due to wheezing(in the last 12months)	None	460 (93.87%)	464 (100.86)
	<1 time a week	18 (3.67%)	35 (7.60%)
	≥ 1 time a week	10 (2.00%)	10 (2.17%)
Speech limitation due to wheezing(in the last 12 months)		19 (3.87%)	31 (6.70%)
History of asthma		37 (7.55%)	16 (3.47%) *
Wheezing during or after exercise		99 (20.20%)	117 (25.43%)
Nocturnal dry cough		136 (27.70%)	145 (31.52%)

* p -value<0.05

7.2 Core questionnaire for asthma

7.2.1 Questionnaire for 13/14 year olds

1	Have you <u>ever</u> had wheezing or whistling in the chest at any time in the past?	Yes No	<input type="checkbox"/> <input type="checkbox"/>
<hr/> IF YOU HAVE ANSWERED "NO" PLEASE SKIP TO QUESTION 6 <hr/>			
2	Have you had wheezing or whistling in the chest <u>in the past 12 months?</u>	Yes No	<input type="checkbox"/> <input type="checkbox"/>
<hr/> IF YOU HAVE ANSWERED "NO" PLEASE SKIP TO QUESTION 6 <hr/>			
3	How many attacks of wheezing have you had <u>in the past 12 months?</u>	None 1 to 3 4 to 12 More than 12	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
4	In the past 12 months, how often, on average, has your sleep been disturbed due to wheezing?	Never woken with wheezing Less than one night per week One or more nights per week	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
5	In the past 12 months, has wheezing ever been severe enough to limit your speech to only one or two words at a time between breaths?	Yes No	<input type="checkbox"/> <input type="checkbox"/>
<hr/> IF YOU HAVE ANSWERED "NO" PLEASE SKIP TO QUESTION 6 <hr/>			
6	Have you <u>ever</u> had asthma?	Yes No	<input type="checkbox"/> <input type="checkbox"/>
7	In the past 12 months, has your chest sounded wheezy during or after exercise?	Yes No	<input type="checkbox"/> <input type="checkbox"/>
8	In the past 12 months, have you had a dry cough at night, apart from a cough associated with a cold or chest infection?	Yes No	<input type="checkbox"/> <input type="checkbox"/>

Figure 1. International study of asthma and allergies in childhood (ISAAC) Questionnaire for 13-14-year-olds

a history of wheezing during exercise (28.4%), and nocturnal dry cough (41.8%). Currently shared bedrooms (25.3%, 9.9%, and 31.5%, respectively), or during the first year of life (24.50 % and 10.9%, respectively) were considerably related to ever wheezing, wheezing during last year, and nocturnal dry cough respectively.

Ever wheezing was significantly ($p < 0.05$) associated with a history of hospitalization (60.8%), history of using spray (59.5%), family history of asthma, allergic rhinitis, and eczema (49.4%, 36.6%, and 32.7% respectively), personal history of food allergy, eczema and allergic rhinitis (42.3%, 41.1%, and 31.5% respectively), and frequent common cold

(30.5%). Medical features associated with wheezing in the last year were personal history of food allergy, eczema and allergic rhinitis (28.9%, 14.7%, and 19.8% respectively), family history of asthma allergic rhinitis, family history of eczema (33.7%, 19.7%, and 19.1% respectively), history of hospitalization (28.4%), use of spray (28.4%), family history of and history of the frequent common cold (15.5%).

Wheezing attacks (3-12 times) in the last year were considerably ($p<0.05$) associated with allergic rhinitis, eczema and food allergy (3.9%, 4.2%, and 10.3% respectively), family history of asthma, allergic rhinitis and eczema (8.4%, 3.8%, and 1.8%), history of hospitalization (9.5%), use of spray (9.5%), frequent common cold (4.7%). However, wheezing attacks more than 12 in the last year were significantly ($p<0.05$) associated with allergic rhinitis, history of hospitalization, spray usage and frequent common cold (2.1%, 2.7%, 1.4%, and 4.3% respectively).

Nocturnal dry cough was significantly ($p<0.05$) associated with a history of the frequent common cold (54.1%), family history of asthma and eczema and allergic rhinitis (51.8%, 44.5%, and 40.3%; respectively), eczema, allergic rhinitis, and food allergy (51.6%, 44.4%, and 43.3% respectively), spray usage (49.3%) history of hospitalization (48.6%).

DISCUSSION

To the best of our knowledge, this is the first report of asthma prevalence in Karaj, one of the metropolitan cities of Iran. The prevalence of wheezing in the last 12 months, as a major index of current asthma,^{8,11} was 10% among 13-14-year-old adolescents in Karaj. This was reported to be 0.8–32.6% in ISAAC, Phase 3, which was done in 97 countries.⁸

The prevalence of current wheezing in this age group reported in different cities of Iran using the ISAAC questionnaire ranged between around 10% in Ahvaz, Birjand, and Bushehr¹²⁻¹⁴ to 25.1% in Kurdistan.¹⁵ However Fazlollahi et al¹⁶ conducted a national cross-sectional study on 16850 individuals of this age in 2015 in Iran and found the prevalence of wheezing in the last year and ever asthma to be 9.5% and 5.1% respectively. However, they reported the total prevalence of asthma as 12.4% because they considered positive answer to wheezing in the last 12 months or ever asthma as the main criteria for 'asthma'.

The range of reported ever asthma prevalence in

other Iranian cities in this age was from 2.1% in Uremia, 7.6%, and 7% in Bushehr and Gorgan to 9.8% in Ahvaz;^{12,17-19} suggesting that geographical location, hot and humid climates might affect the asthma prevalence in these regions. A systematic review in 2016 showed that the prevalence of asthma symptoms among 13-14-year-old adolescents in the Middle East countries was 7.57%. The lowest and highest number of asthmatic children were reported in Isfahan, Iran, and Baghdad, Iraq (0.7% and 22.3%; respectively).¹⁹

The prevalence of ever asthma in Karaj in the current study was 5.3%, almost equal to the mean prevalence of asthma in the Middle East according to the Global Initiative for Asthma (5.8%)²⁰ and Fazlollahi et al study (5.3%),¹⁶ but higher than some other cities in Iran such as Urmia, Qazvin, and Kurdistan (2.1%, 2.2%, and 3.9%).^{15,17,21} This could be explained by the fact that Karaj is a metropolitan city, located in an industrial area and is surrounded by many fields and gardens, city dwellers are exposed to a variety of pollination pollens.

Consistent with other studies, the rate of ever and current wheezing (20.9% and 10%; respectively) in our study was much higher than ever asthma (5.3%). These figures were also reported in Qazvin²¹ where ever asthma, ever and current wheezing were reported to be 2.2%, 26%, and 17.65%, respectively. Likewise, these were 7%, 30.5%, and 20%, respectively in Gorgan.¹⁸ This can be due to some reasons. Firstly, the interpretation of wheezing may vary among different people with different cultures and education. Moreover, there is an under-diagnosis of asthma since many parents may deny asthma because of social stigma. A survey in Asian Pacific countries in which the mean prevalence of ever asthma and current wheezing was found to be 12.6% (5% in Seoul and 26.5% in Singapore) and 8.8% (4.8% in Guangzhou and 13.9% in Bangkok) respectively.²² The prevalence of ever and current wheezing in our study were significantly more than their results, which might be explained by different time as well as the diversity of geographic location and ethnic origin.

Similar to most of the studies^{15,16,23,24} in Iran, we found that the history of asthma was significantly higher in boys than girls. However, opposite results were reported from some other cities.^{12,25}

Three percent of our study group experienced wheezing attacks more than 4 times, 5% had speech limitations due to wheezing and 2% of the individuals

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reported nocturnal awakening more than once a week during the last year. Asthma severity is commonly assessed by these three items. So, the prevalence of severe asthma in this study might be between 2% and 5% which is not so different from its global and local amount, ranged from 3.8% in Northern and Eastern Europe, Asia-Pacific to 11.3% in North America and 4.7% in Iran.^{8,16} However, in Ahvaz and Gorgan (10.7% and 11.8% respectively) it was much higher than ours. Therefore, a hot and humid climate affects not only asthma prevalence, but also its severity.

The present study had some limitations including its relatively small sample size and not including rural areas and elementary school students.

Although the prevalence of asthma in this study was close to the national average based on the ISAAC questionnaire, nocturnal cough, and exercise-induced wheezing were higher in Karaj compared to other cities of Iran; which could be due to high air pollution in this industrial area.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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