

## Prevalence of asthma and related symptoms among schoolchildren in Dezful city, Southwestern Iran

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### Abstract

**Background:** Asthma is a chronic respiratory disease and a major public health problem globally. This study aimed to determine the prevalence of asthma and related symptoms in schoolchildren in Dezful city, southwest Iran.

**Methods:** In this cross-sectional descriptive analytical study, the prevalence of asthma symptoms was measured using a randomized cluster sampling method among 2,978 schoolchildren aged 6-14 years. A validated questionnaire from the International Study of Asthma and Allergies in Childhood (ISAAC) was used from January to February 2020. The chi-square test was used to determine the relationship between variables, which were expressed as percentages, with a P-Value < 0.05 considered statistically significant.

**Results:** The overall prevalence of asthma was 4.7% (CI=3.98 - 5.54), significantly higher among 13-14-year-olds compared to the 6-7-year-old age group (6.4% vs. 3.1%, P-Value < 0.001) and in males versus females (6.9% vs. 2.5%, P-Value < 0.001). The total prevalence of wheezing in the last year, the main symptom of asthma, was 7.2% (CI=6.31 - 8.20), significantly higher among 13-14-year-olds (8.4% vs. 6.1%, P-Value < 0.009) and male schoolchildren (9.6% vs. 4.7%, P-Value < 0.001).

**Conclusion:** According to our findings, and compared to the previous ISAAC study in Iran, the prevalence of asthma symptoms was relatively low among Dezful schoolchildren.

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### Highlights

#### What is current knowledge?

Asthma is a chronic respiratory disease and a major public health problem worldwide. It is estimated that the number of people with asthma may exceed 300 million globally. Overall, the prevalence of asthma in Iranian children is lower than in other regions of the world.

#### What is new here?

The prevalence of asthma and the severity of symptoms in Dezful were relatively low among schoolchildren compared to similar studies in this region and other Middle Eastern countries.

### Introduction

Asthma is a major public health problem globally, affecting all age groups, especially children. Delays in diagnosis and lack of treatment can exacerbate respiratory tract involvement and, in the long run, lead to sustained changes that decrease respiratory capacity. Hence, identifying asthma symptoms related to childhood asthma is key to achieving an accurate diagnosis and timely treatment of this disease (1-4).

It is estimated that over 300 million people worldwide have asthma, according to a report from the Global Asthma Network. This number is expected to reach 400 million by 2025 (5-7).

Asthma prevalence varies among different countries and even within regions of the same country due to diversity in environmental conditions and lifestyles (3). The global prevalence of asthma in schoolchildren ranges from 2 to 8% in Indonesia to 37.6% in Costa Rica among children aged 6-7 years, and from 3.4% in Albania to 31.2% on the Isle of Man among children aged 13-14 years (8,9).

Many studies have examined the prevalence of asthma among Iranian children in various cities. The results show that the prevalence of asthma symptoms ranges from 2.7% in Kerman to 35.4% in Tehran, with the overall national prevalence estimated at 13.14% (10,11).

In Iran, many studies have investigated the prevalence of asthma symptoms in schoolchildren, but no similar study has been conducted in Dezful, southwest Iran. Given that geographic, ethnic, and socioeconomic factors influence asthma prevalence, this study was designed to assess the prevalence of asthma in schoolchildren aged 6-14 years in Dezful, Iran.

### Methods

A cross-sectional descriptive-analytical study was conducted on schoolchildren aged 6-14 years in Dezful city, southwest Iran, from January to February 2020.

Dezful is located at an altitude of 143 m above sea level and has a warm, semi-desert climate. It is the second-largest city in Khuzestan province, with a population of 843,971 people (12).

This study was conducted based on the Phase I International Study of Asthma and Allergies in Childhood (ISAAC) protocol (13).

According to ISAAC recommendations, a sample size of at least 3,000 subjects is required to obtain a reliable prevalence estimate. To ensure the required sample size, an additional 10% was added, bringing the total to 3,300 schoolchildren, who were selected using a cluster random sampling method. Since the sampling unit was the school, and based on the number of male and female students aged 6-14 years and the required sample size, 32 public and private schools from both educational districts in urban areas of Dezful were selected.

The Persian versions of the ISAAC questionnaires (Translated by the National Research Institute of Tuberculosis and Lung Disease, Tehran, Iran) were used to estimate asthma symptoms. This instrument had been translated according to ISAAC recommendations and previously administered to Iranian schoolchildren in Tehran and Rasht, with the findings published in the ISAAC Steering Committee report (14).

After obtaining consent from the Ministry of Education, the 6-7-year-old schoolchildren were asked to take the questionnaires home along with a letter of explanation. The questionnaires were completed by the parents and returned to the school. The 13-14-year-old schoolchildren completed the questionnaires in the classroom under the supervision of trained interviewers, following the ISAAC methodology. In this study, all ethical standards, including maintaining the anonymity of the schoolchildren, were observed.

The data were analyzed using SPSS version 16.0 and presented as simple frequency measures (%) and confidence intervals (CI). The significance of differences between proportions was calculated using the chi-squared test, with a P-value < 0.05 considered statistically significant.

### Results

Of the 3,300 questionnaires distributed, 2,978 completed questionnaires were returned (Response rate: 90.3%). A total of 2,978 students were included, with 1,500 (50.5%) aged 6-7 and 1,478 (49.5%) aged 13-14, including 1,453 girls (48.8%) and 1,525 boys (51.2%).

The prevalence of asthma and asthma symptoms in schoolchildren by age group is summarized in Table 1. The total prevalence of ever wheeze, current wheeze, and asthma diagnosed by a physician among schoolchildren aged 6-14 years was 10.6%, 7.2%, and 4.7%, respectively. The prevalence of ever wheeze, current wheeze, and physician-diagnosed asthma was significantly higher in the 13-14-year age group (12.7%, 8.4%, and 6.4%, respectively) compared with the 6-7-year age group (8.7%, 6.1%, and 3.1%, respectively). Asthma prevalence was significantly higher in 13-14-year-olds (6.4% vs. 3.1%, P-Value < 0.001) and in males (6.9% vs. 2.5%, P-Value < 0.001). Additionally, the prevalence of wheezing in the last year, as the main symptom of asthma, was significantly higher in 13-14-year-olds (8.4% vs. 6.1%, P-Value < 0.001) and in male schoolchildren (9.6% vs. 4.7%, P-Value < 0.009).

A comparison of asthma symptoms in male and female schoolchildren revealed that wheezing, ever having asthma, nocturnal dry cough, and asthma during the last year were significantly more prevalent in males compared to female schoolchildren (P-Value > 0.001). However, no significant relationship was found between the two sexes regarding speech limited by wheezing. A total of 123 (4.1%) schoolchildren reported a wheezing attack in the past year, while only 0.3% reported four or more wheezing attacks; these figures were significantly higher in male schoolchildren (P-Value = 0.01). Severe wheezing attacks that limited speech were reported by 41 children (1.4%), with no significant differences between males and females (P-Value = 0.12). Overall, severe asthma was observed in 76 (2.6%) schoolchildren and was significantly more prevalent in males and 13-14-year-old schoolchildren (Table 2).

**Table 1.** Prevalence of asthma and asthma symptoms by age groups

Symptoms	Total No. (Percentage) CI (95%)	6-7-year-old No. (Percentage) CI (95%)	13-14-year-old No. (Percentage) CI (95%)	P-Value
Wheezing ever	317 (10.6) (9.53 - 11.77)	130 (8.7) (7.35 - 10.27)	187 (12.7) (11.07 - 14.53)	< 0.001*
Wheezing in the past year (Current wheezing)	215 (7.2) (6.31 - 8.20)	91 (6.1) (4.97 - 7.46)	124 (8.4) (7.06 - 9.96)	0.009*
No. of wheezing attacks in the past year				
1-3	81 (2.7) (2.16 - 3.36)	39 (2.6) (1.88 - 3.57)	42 (2.8) (2.04 - 3.81)	0.058
4-12	33 (1.1) (0.77 - 1.56)	11 (0.7) (0.36 - 1.31)	22 (1.5) (0.97 - 2.30)	
> 12	9 (0.3) (0.15 - 0.59)	2 (0.1) (0.01 - 0.48)	7 (0.5) (0.22 - 1.05)	
No. of episodes of sleep disturbance from wheezing in past year				
< 1 per week	63 (2.1) (1.63 - 2.70)	26 (1.7) (1.13 - 2.53)	37 (2.5) (1.79 - 3.47)	0.037*
≥ 1 per week	26 (0.9) (0.60 - 1.33)	14 (0.9) (0.51 - 1.56)	12 (0.8) (0.43 - 1.44)	
Speech limited by wheezing in past year	41 (1.4) (1.02 - 1.91)	14 (0.9) (0.51 - 1.56)	27 (1.8) (1.21 - 2.65)	0.036*
Asthma ever	141 (4.7) (3.98 - 5.54)	47 (3.1) (2.31 - 4.14)	94 (6.4) (5.23 - 7.80)	< 0.001*
Severe asthma	76 (2.6) (2.07 - 3.25)	30 (2) (1.38 - 2.88)	46 (3.1) (2.30 - 4.15)	< 0.001*
Exercise-related wheezing in past year	190 (6.4) (5.56 - 7.35)	39 (2.6) (1.88 - 3.57)	151 (10.2) (8.73 - 11.88)	< 0.001*
Dry cough at night in past year	278 (9.3) (8.29 - 10.41)	106 (7.1) (5.88 - 8.55)	172 (11.6) (10.03 - 13.37)	< 0.001*

\* P-Value < 0.05 was considered significant

**Table 2.** Prevalence of asthma and asthma symptoms by gender

Symptoms	Boy No. (Percentage) CI 95%	Girl No. (Percentage) CI 95%	P-Value
Wheezing ever	206 (13.5) (11.85 - 15.34)	111 (7.6) (6.31 - 9.11)	< 0.001*
Wheezing in the past year (Current wheezing)	146 (9.6) (8.19 - 11.22)	69 (4.7) (3.70 - 5.95)	< 0.001*
No. of wheezing episodes in past year			
1-3	52 (3.4) (2.57 - 4.47)	29 (2.0) (1.37 - 2.90)	0.01*
4-12	22 (1.4) (0.89 - 2.16)	11 (0.8) (0.43 - 1.45)	
> 12	6 (0.4) (0.16 - 0.91)	3 (0.2) (0.05 - 0.65)	
No. of episodes of sleep disturbance from wheezing in past year			
< 1 per week	41 (2.7) (1.97 - 3.68)	22 (1.5) (0.96 - 2.31)	0.001*
≥ 1 per week	21 (1.4) (0.89 - 2.16)	5 (0.3) (0.10 - 0.79)	
Speech limited by wheezing in past year	26 (1.7) (1.14 - 2.52)	15 (1.0) (0.58 - 1.70)	0.12
Asthma ever	105 (6.9) (5.70 - 8.32)	36 (2.5) (1.78 - 3.48)	< 0.001*
Severe asthma	53 (3.5) (2.66 - 4.58)	23 (1.6) (1.04 - 2.43)	< 0.001*
Exercise-related wheezing in past year	129 (8.5) (7.17 - 10.04)	61 (4.2) (3.25 - 5.40)	< 0.001*
Dry cough at night in past year	173 (11.3) (9.78 - 13.02)	105 (7.2) (5.95 - 8.68)	< 0.001*

\* P-Value < 0.05 was considered significant

## Discussion

According to the findings of this study, the overall prevalence of asthma in 6-14-year-old schoolchildren was 4.7%; in the 6-7-year-old and 13-14-year-old age groups, it was 3.1% and 6.4%, respectively. Since our study was the first to assess the prevalence of asthma in Dezful schoolchildren, we cannot compare our results with previous data from this city. However, we can confirm a relatively lower prevalence of asthma in Dezful compared with some cities in Iran, the eastern Mediterranean region, and other developing countries (6,15,16).

According to the ISAAC protocol, in a large national population-based survey in Iran, the overall prevalence of asthma in schoolchildren was 10.9%; among 6-7-year-olds and 13-14-year-olds, it was 9.4% and 12.4%, respectively (16). In a systematic review including 50 studies from Middle Eastern countries, the overall prevalence of asthma was 7.43% in 6-7-year-old schoolchildren and 7.57% in the 13-14-year age group (6). These statistics were higher than those obtained in the current study (3.1% and 6.4%, respectively). However, similar statistics were found when comparing the results of the current survey with those from some other cities in Iran (17,18). In a cross-sectional study conducted in 2020 in Yazd city in central Iran (17), the prevalence of asthma in schoolchildren was 4.8%, which is similar to the results of the current study. Nevertheless, in another study of schoolchildren from Zanjan city in 2020 (19), the prevalence of asthma was 1%, which was remarkably lower than the figures obtained in the current study. In addition, according to a systematic review of 28 articles from Iran with a total of 96,822 participants, the prevalence of asthma was reported at 9.3% (20). Environmental factors and climatic differences are key to explaining the variations and changes in the prevalence of asthma in different areas.

The overall prevalence of current wheezing as the main index of asthma in schoolchildren was 7.2%. Among 6-7-year-olds and 13-14-year-olds, it was 6.1% and 8.4%, respectively. According to a national asthma report in Iran, the prevalence of current wheezing in schoolchildren was 7.8% among 6-7-year-olds and 9.5% among 13-14-year-olds (16), which was slightly higher than the results in the current study. According to a global asthma report, the prevalence of current wheezing in Iran was 9.7% and 10.8% among 6-7-year-olds and 13-14-year-olds, respectively (21).

The overall prevalence of severe asthma was 2.6%, which was significantly higher in 13-14-year-olds compared to 6-7-year-olds (3.1% vs. 2%, P-Value = 0.001). In a cross-sectional study conducted in Iran involving a total of 33,260 schoolchildren, severe asthma was reported at 3.9%; among 6-7-year-olds, it was 3%, and among 13-14-year-olds, it was 4.7% (16). According to the study by Lai et al., the global prevalence of severe asthma was 4.9% among 6-7-year-olds, ranging from 3.2% in Europe and Asia-Pacific to 9.5% in Oceania. Additionally, 6.9% of children aged 13-14 suffered from severe asthma worldwide, ranging from 3.8% in Europe and Asia-Pacific to 11.3% in North America (22). These statistics were higher than the calculated prevalence of severe asthma in the current study. The researchers suggest that the high prevalence of severe asthma in European children compared to the world and Asia-Pacific countries is most likely attributed to industrialization and air pollution (5).

The higher prevalence of asthma in boys and adolescents is distinctly consistent with what is expected according to the literature and previous studies, which indicate that the prevalence of asthma in boys and adolescents is higher, with male sex reported as a risk factor for asthma in childhood (2,21). According to most studies in Iran and other countries (16,21,23), the prevalence of asthma and related symptoms was significantly higher in boys than in girls. However, different findings have been reported from some other areas (9,24). It seems that asthma is more prevalent in males, both among schoolchildren and the adult population. Hormonal alterations and gender-specific differences in environmental exposures have been proposed as possible explanations for this difference (16).

## Conclusion

The prevalence of asthma and the severity of symptoms in Dezful were relatively low in schoolchildren compared with similar studies in this region and other Middle Eastern countries.

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None

## Ethical statement

This study is a research project approved by the Ethics Research Committee of Ahvaz Jundishapur University of Medical Sciences, with the code IR.AJUMS.REC.1397.536. In this study, all ethical standards have been observed, including the confidentiality of the names and identities of the medical students.

## Conflicts of interest

None

## Author contributions

Conceptualization: Abdolhussein Shakurnia, Mohammad Nejadhosseini. Methodology: Abdolkarim Sheikhi, Abdolhussein Shakurnia. Data Collection: Mohammad Nejadhosseini. Data Analysis and Interpretation: Abdolhussein Shakurnia, Farhad Abolnezhadian, Mohammad Nejadhosseini. Drafting the Manuscript: Abdolkarim Sheikhi, Abdolhussein Shakurnia. All Authors have reviewed and approved the final version of the manuscript for submission.

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