

# The Prevalence and Risk Factors of Asthma, Allergic Rhinitis, and Eczema in Primary School Children, Zanjan, Iran

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## ABSTRACT

**Background & Objective:** Allergies are manifested with a variety of signs and symptoms. In this study, the frequencies of asthma symptoms, allergic rhinitis, eczema, and related factors among 6- to 7-year-old schoolchildren were investigated.

**Materials & Methods:** This cross-sectional study was carried out among schoolchildren of 35 elementary schools of Zanjan by using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire consisting of the following: asthma symptoms, allergic rhinitis, atopic dermatitis, sex, weight, height, feeding, paracetamol and antibiotic use, maternal education, physical activity, exposure to pets or farm animals, heavy traffic exposure, and parental tobacco use. Data were gathered and analyzed by SPSS software.

**Results:** In this study, 800 children (383 girls and 417 boys) were recruited. The prevalence of wheezing was 28% (95% Confidence Interval; 27, 36), rhinitis 20% (95% CI; 19, 27), and dermatitis 16.8% (95% CI; 13.1, 17.5). However, the rates of physician-diagnosed asthma, allergic rhinitis, and eczema were 1%, 8.9%, and 4.1%, respectively. The prevalence rates of asthma symptoms and atopic dermatitis were significantly higher in girls than in boys ( $P=0.01$  and  $P<0.001$ , respectively). The weight of children with asthma was significantly higher than children without asthma ( $P=0.01$ ).

**Conclusion:** The frequencies of wheezing, rhinitis, and dermatitis among 6- to 7-year-old children were high. Thus, symptoms and history should be considered for the accurate diagnosis and management of children.

**Keywords:** Diabetic retinopathy, RBP4, RBP4 delivery kinetic, Vitamin A



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## Introduction

Asthma is the most common inflammatory disorder in children. The inflammatory process in airways leads to obstructions that manifest as recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. Airflow obstruction is also widespread and variable and shows mild to severe symptoms (1). Allergic phenomena have a wide range of symptoms and signs. The allergic march is appearances of atopic disease with eczema and progression to asthma, and then to allergic rhinoconjunctivitis (2).

Allergic rhinitis or rhinoconjunctivitis is a challenging allergic problem. It clinically diagnosed based on symptoms of nasal congestion, sneezing, rhinorrhea, and nasal or ocular pruritus, or it could be presented with eye tearing along with nasal symptoms (3).

Atopic dermatitis is a chronic inflammatory itchy skin rash, which often occurs in early infancy (4). It is a major risk factor for the development of asthma. Also, the risk of developing asthma among children with atopic dermatitis has been shown to be two times higher than in children without atopic dermatitis (5, 6). Allergic rhinitis is also a common disorder in patients with asthma (7). The recurrent and chronic nature of these disorders imposes a heavy burden on families and society because of significant health care costs and reduced daily activity and school function. Therefore, it could impair the quality of life of affected individuals (8, 9).

The prevalence rates of asthma and wheezing among 6- to 7-year-old children in Iran have been reported as 2.7% (95% confidence interval (CI); 1.9, 3.6) and 7.6% (95% CI; 5.6, 9.8), respectively (10). The prevalence of

allergic rhinitis was also reported as being about 11–40% in different parts of Iran (11–14). Some epidemiologic studies have shown that the prevalence of atopic dermatitis is 13.4–17% among children in different parts of the world (4, 6, 13). Previous studies in Zanjan (among middle school students) have shown that the prevalence rates of asthma symptoms, allergic rhinitis, and atopic dermatitis were 13–15%, 14%, and 12%, respectively (15, 16). However, findings among younger children are limited. The aim of this study was to investigate the allergic symptoms among 6- to 7-year-old school children in Zanjan.

## Materials and Methods

This cross-sectional study was conducted from November 2016 to May 2017, and 1,000 children (6- to 7-year-old) from 35 primary schools in Zanjan city were randomly selected by multivariate cluster sampling and entered the study. After description of the study, the International Study of Asthma and Allergies in Childhood (ISAAC) core questionnaire on asthma, rhinitis, and eczema (17) were given to children. They were asked to fill them out at home with the help of their parents (after giving consent). In addition, information about demographic findings and environmental factors was assessed by the ISAAC environmental questionnaire, including sex, weight, height, eating diet, two or more siblings, paracetamol use, antibiotic consumption, maternal education, exercise and television watching program, exposure to pets or farm animals, heavy traffic exposure, and parental tobacco use. Data were gathered and analyzed by SPSS 16 (SPSS Inc., Chicago, Ill., USA).

## Results

Questionnaires were filled out and returned by 800 (out of 1000) 6- to 7-year-old children (383 girls and 417 boys). The prevalence of wheezing was 28.5% (95% CI; 27, 36), and the prevalence of physician-diagnosed asthma was 1% (95% CI; 0.6, 1.2). Severe asthma symptoms, on the basis of night problem > 1/night problem, speech and activity limitation, were

seen in 1.7%, 1.8%, and 4.5% of children, respectively (Table 1).

Rhinitis symptoms were 20% (95% CI [19, 27]), and the physician-diagnosed allergic rhinitis was 8.9% (95% CI [8, 11]). Most of the children had mild symptoms of rhinitis (Table 2).

Itchy rash was also reported 16.8% (95% CI [13.1, 17.5]), and the prevalence of eczema was 4.1% (95% CI [3, 6]) (Table 3).

The prevalence rates of asthma symptoms and atopic dermatitis were significantly higher in girls than in boys ( $P=0.01$  and  $P<0.001$ , respectively). There was no significant association of allergic rhinitis or atopic dermatitis with weight, height, and birth weight. However, the weight of children with wheezing was significantly higher than children without asthma. There was no association of a history of breastfeeding, having two or more siblings, number of hours spent watching television, or heavy traffic exposure with wheezing, rhinitis, and dermatitis. We found a significant association between fast food consumption and dermatitis ( $P=0.04$ ). Wheezing was significantly higher in children who had exposure to pets in the first year of life ( $P=0.008$ ).

However, there was also a significant correlation between asthma, wheezing, and dermatitis with exposure to pets during the last 12 months. There was a significant association between exposure to domestic animals in the first year of life and wheezing ( $P=0.044$ ) and rhinitis ( $P=0.004$ ) frequencies. The amount of physical activity per week was also significantly higher among children with wheezing ( $P=0.000$ ), rhinitis ( $P=0.001$ ), and dermatitis ( $P=0.012$ ). Parental tobacco smoking was significantly higher in children with rhinitis ( $P=0.001$ ) and dermatitis ( $P=0.008$ ). There was a significant association between paracetamol use in the first year of life and wheezing ( $P=0.000$ ) and rhinitis ( $P=0.003$ ). In addition, the frequency of antibiotic consumption during the first year of life was significantly higher among children with wheezing ( $P=0.002$ ) and rhinitis ( $P=0.006$ ). There was also a significant direct association between wheezing and mother's education level ( $P=0.001$ ) (Table 4).

**Table 1. The prevalence rates of wheezing and asthma symptoms among school children**

Symptoms	Girls (%)	Boys (%)	Total	
			Number	Percent (95% CI)
Ever wheezing	119 (31.1)	106 (26.1)	225	28.1 (27-36)
Wheezing since 12 months	67 (17.5)	45 (10.8)	112	14 (11-18)
Wheezing attacks/ month				
1-3	37 (9.7)	35 (8.4)	72	9
4-12	2 (0.52)	2 (0.48)	4	0.5
>12	2 (0.52)	2 (0.48)	4	0.5

Symptoms	Girls (%)	Boys (%)	Total	
			Number	Percent (95% CI)
<b>Night problem / week</b>				
<1 night	43 (11.2)	32 (7.8)	75	9.6
>1 night	5 (1.2)	8 (1.9)	13	1.7
<b>Speech problem</b>	8 (2.1)	6 (1.4)	14	1.8
<b>Dry cough since 12 months</b>	66 (17.2)	62 (14.9)	128	16 (15-21)
<b>Wheezing during exercise</b>	15 (3.9)	20 (4.8)	35	4.5 (3.5- 7)
<b>Asthma</b>	4 (1.1)	4 (1)	8	1 (0. 6-1.2)

**Table 2.** The prevalence rates of rhinitis, rhinoconjunctivitis, and physician-diagnosed allergic rhinitis among school children

Symptoms	Girls (%)	Boys (%)	Total	
			Number	Percent (95% CI)
<b>Rhinitis</b>	78 (20.4)	82 (19.7)	160	20 (19-27)
<b>Rhinitis during 12 months</b>	78 (20.4)	62 (15.2)	140	17.9 (17-24)
<b>Rhinoconjunctivitis</b>	39 (10.4)	38 (9.4)	77	9.6 (8.5-12)
<b>Impact on daily activity</b>				
<b>Mild</b>	48 (12.5)	53 (12.7)	101	12.6
<b>Moderate</b>	28 (7.3)	25 (5.9)	53	6.6
<b>Sever</b>	2 (0.5)	4 (0.9)	6	0.7
<b>Allergic Rhinitis</b>	34 (8.9)	34 (8.1)	68	8.5 (8-11)

**Table 3.** The prevalence of dermatitis symptoms, severity, and physician-diagnosed eczema among school children

Symptoms	Girls (%)	Boys (%)	Total	
			Number	Percent (95% CI)
<b>Itchy rash</b>	73(19)	62 (14.8)	135	16.8 (13.1-17.5)
<b>Rash during 12 months</b>	59 (15.4)	38 (9.1)	97	12.4 (12-17)
<b>Sleep disorder</b>	34(8.8)	20 (4.7)	54	6.7
< 1 nigh per week	28 (7.3)	18 (4.3)	46	5.7
≥ 1 night per week	6 (1.5)	2 (0.5)	8	1
<b>Age of appearance</b>				
<2 year	28 (7.3)	23 (5.5)	51	6.4
2-4 year	21 (5.4)	15 (3.6)	36	4.5
≥ 5 year	24 (6.3)	24 (5.7)	48	6
<b>Eczema</b>	22 (5.7)	11 (2.6)	33	4.1 (3-6)

**Table 4.** The assessment of demographic and environmental factors in children with asthma, rhinitis, and dermatitis symptoms in comparison to children without these symptoms

Variable	Asthma			Rhinitis			Eczema		
	yes	no	PV	yes	no	PV	yes	no	PV
Wight(Kg)	24.8±5.1	24.04±5.04	0.01*	24.6±5.5	24.06±5.7	0.14	23.9±3.8	24.3±5.1	0.8
Height(cm)	122.6±8.5	120.9±13.4	0.16	120.8±13.2	121.8±11.4	0.27	119.7±13.5	121.5±12.1	0.61
Birth weight (gr)	2480±510	2474±504	0.21	2464±550	2406±479	0.14	2392±388	2428±509	0.8
Fast food(%)	73.6	71.2	0.112	67.8	60.4	0.09	88.8	61.8	0.004*
†BMF (%)	87.6	88.6	0.96	78	80.2	0.84	75	80	0.95
Pet exposure first year (%)	11.2	5.3	0.008*	8.6	6.1	0.08	18.1	6.9	0.004*
Recent pet exposure(%)	11.6	7.6	0.05*	9.8	8.2	0.05*	18.1	9	0.001*
Domestic First year(%)	10.7	6.1	0.008*	12.8	5.2	0.004*	18.1	7.3	0.002*
Tobacco(%)	28.4	30.4	0.73	41.3	23.8	0.001*	42.8	25.8	0.008*
Paracetamol (%)	90.3	78.2	0.000*	87	65	0.003	78	82	0.81
Antibiotic (%)	50.3	39.5	0.002*	48.6	39.5	0.006*	50	43.5	0.35
□Heavy traffic(%)	34.1	41.3	0.06	43.3	36.4	0.11	35.7	38.7	0.4
Mother collage education(%)	70.5	57.1	0.001*	62.3	60.6	0.69	53.8	61.7	0.48
TV watching > 5 hr/day (%)	27.9	26.3	0.16	28	20	0.09	27.4	22.1	0.37
Activity > 3/wk	42.5	26.5	0.000*	37.6	27.6	0.01*	38.6	29.7	0.012*
> 2 siblings	8.8	16.1	0.052	14.2	14.4	0.69	15.9	14.7	0.92

†: Breast milk feeding; □: Almost all day long trucks pass through the street

## Discussion

Our study showed that about 28% of children had wheezing, and 14% had recent wheezing; these rates are higher than those reported by Mohammadzadeh and coworkers, whose study was done in the northern part of Iran, although lower night symptoms were presented in our study (4.6% vs. 1.7%) (18). Another investigation in the western part of Iran reported a higher prevalence of recent wheezing, exercise-induced, and sleep problems (19). On the other hand, the rate of physician-diagnosed asthma in our study was 1%, which is much lower than similar reports and is approximately three times lower than the value presented in a systematic review study that illustrated asthma prevalence rates in several parts of Iran (10, 18, 20). The prevalence of recent wheezing is 14 times higher than doctor-diagnosed asthma. Regarding differences in access to health care services, parents' concerns about the term of asthma, the risk of bias, and denying on the diagnoses that make by physicians, relying on wheezing symptoms may be more accordable.

The prevalence of rhinitis symptoms was 20%, and that of allergic rhinitis was 8.9%, which is lower than results among adolescents (15, 21, 22), although some studies in preschool children showed a higher prevalence of rhinitis symptoms (14, 23). However, several studies presented lower rates of rhinitis among 6- to 7-year-old children in comparison with our results (18, 24). The time and period of exposure to environmental allergens, along with genetic factors in different geographic areas, could explain this variability.

We found that 135 (16.8%) children had a history of itchy rashes, 12.4% had a current itchy rash, and 4.1% had confirmed eczema. These findings are in accordance with the results of several studies involving children (12, 25, 26). However, some studies, particularly in tropical and northern areas, showed a higher frequency of atopic dermatitis (4, 6, 11, 27, 28). The period of exposure and higher contact with environmental allergens in these areas could be an important factor that induces higher rates of sensitization and dermatitis.

Although there is a higher risk of allergic disorders among boys during childhood (12, 26, 29, 30), our study showed that asthma and atopic dermatitis in girls were significantly higher than in boys. This is consistent with the study of Masjedi *et al.*, who reported a higher rate of wheezy girls than boys (20). There was also a similar distribution of allergic rhinitis among boys and girls in our study. It seems that lifestyle and habitual factors, in addition to genetic or environmental factors, must be considered as probable risk factors for female vs. male predominance.

We found a significant association between asthma and the weight of children, which is compatible with our previous study in children (31). There were significant associations between mother's education, exposure to pets and domestic animals, and antibiotic and paracetamol consumption in the first year of life and asthma. The increased risk of asthma with antibiotics and paracetamol use has been confirmed in many investigations. While some of these factors were shown to have protective effects in some studies, they were shown to be risk factors in others (1, 32–36). Increasing hygiene and reduction of exposure to infectious pathogens is likely an important factor for increasing T helper 2 (Th2) cell activation and rising allergic trend in susceptible subjects.

Allergic rhinitis was higher among children exposed to parental tobacco smoking, domestic animals, and paracetamol and antibiotics use during the first year of life. Consistent with our study, Safari and coworkers showed that smoking and pet exposure were high among children with allergic rhinitis (22). However, this association was not shown in the study of Salarnia *et al.* (14). Children with atopic dermatitis had high rates of fast food consumption and parental tobacco smoking. In a large logistic regression study, there were strong associations between paracetamol use and early-life antibiotics and eczema among 6- to 7-year-old children. In addition, high associations were reported with current paracetamol use, open-fire cooking, and exposure to heavy traffic and risk of atopic dermatitis (37).

It has been confirmed that atopic dermatitis is an important risk factor for asthma and allergic rhinitis, and close correlations between allergic rhinitis, asthma, and atopic dermatitis have been observed (11, 27, 38). Therefore, the etiology and risk factors for the appearance and exacerbation of these disorders could be similar. However, the period and route of contact with various allergens in different environments might induce different symptoms of allergies.

## Conclusion

We found high frequencies of asthma symptoms, allergic rhinitis, and dermatitis among primary school children. Thus, preventive measures, along with the early detection of atopy based on allergic symptoms,

might be informative and reduce the burden of these disorders.

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## Conflict of Interest

Authors declared no conflict of interest.

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