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The prevalence of asthma, allergic rhinitis, and eczema among middle school students in Tabriz (northwestern Iran)

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Aim: To investigate the prevalence of atopic syndrome and the associated risk factors among middle school students. Asthma, allergic rhinitis, and eczema have an extensive epidemiologic diversity in various geographic areas.

Materials and methods: This cross-sectional study was performed on 1508 students in the city of Tabriz (a northwestern Turkish-populated region of Iran) in 2009. The International Study of Asthma and Allergies in Childhood questionnaire was used to collect data. The collected data was analyzed using SPSS 16.

Results: The prevalence of cumulative and periodic wheezing and diagnosed asthma was 3.7%, 2.9%, and 2%, respectively. The diagnosed prevalence of cumulative and periodic allergic rhinitis and hay fever was 17.1%, 16.0%, and 13.6%, respectively. For cumulative and periodic nocturnal rash and eczema, the diagnosed prevalence was 5.4%, 4.7%, and 7.3%, respectively. Asthma symptoms were more prevalent in the western part of the city than in the central and eastern parts, and boys were more likely to have symptoms of rhinitis and eczema than girls. Having pets and a history of hospitalization increased the chance of eczema, and advanced maternal age was correlated with the presence of asthma symptoms. Breastfeeding, household size, and exposure to cigarette smoke did not have any effect on the appearance of atopic diseases.

Conclusion: The small difference observed in this study between the prevalence of cumulative and periodic allergic rhinitis could be caused by the sharp recent increase in allergic rhinitis prevalence. An ecological survey in the western part of the city could be valuable in helping to determine the factors contributing to the higher prevalence of asthma there in comparison with the central and eastern parts. Such a survey should examine demographic, environmental, and even ethnic variables in this geographical region and perhaps even in adjacent countries.

Key words: Asthma, allergic rhinitis, eczema, students, Tabriz, Iran

Word definition: Atopic syndrome: Asthma, allergic rhinitis (hay fever), and eczema are all parts of atopic syndrome.

Abbreviations: Cumulative wheezing prevalence: CWP; prevalence of wheezing attack in the past year: WYP; doctor-diagnosed asthma prevalence: DAP; cumulative allergic rhinitis prevalence: CARP; prevalence of allergic rhinitis in the past year: ARYP; doctor-diagnosed hay fever prevalence: DHFP; cumulative itchy rash prevalence: CRP; prevalence of itchy rash in the past year: RYP; doctor-diagnosed eczema prevalence: DEP; International Study of Asthma and Allergies in Childhood: ISAAC.

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Introduction

Atopic diseases have a wide range of occurrence throughout the world and it is often found that their prevalence is lower in developing countries than in developed countries (1). The geographical distribution of hay fever and eczema is not as obvious as is the case with asthma, however (2). The highest 1-year prevalence (20%) of wheezing, the main symptom of asthma, was found in developed countries, including Australia, New Zealand, Ireland, and the UK, while the lowest prevalence (5% or less) was reported in East European countries, Indonesia, Greece, China, Taiwan, Uzbekistan, India, and Ethiopia (2). The prevalence of asthma in Iran was estimated to be as high as 13.14% in an international report. In a national survey based on the International Study of Asthma and Allergies in Childhood (ISAAC), the lowest prevalence was 2.7% (in Kerman) and the highest was 35.3% (in Tehran) (3).

Asthma, allergic rhinitis, and eczema are the most prevalent chronic diseases in children (1,4). Various reports and data have been published regarding trends in the prevalence of atopic diseases; it seems that the prevalence of asthma is increasing in various parts of the world (4-6), so much so that the yearly prevalence of asthma among children has doubled over the past 20 years (4). Meanwhile, a number of recent studies have shown differing results regarding the trend of disease prevalence (6). Atopic diseases impose heavy social and economic burdens due to their chronicity. Additionally, they can impede various functions of the body, leading to problems including pulmonary dysfunction and apnea in 80% of asthmatic individuals (7), as well as dyspnea, ear infections, sinusitis, headache, and mouth and tooth abnormalities. Numerous studies have also reported that children with atopic diseases suffer from a variety of psychological illnesses (7). It is noteworthy that asthma is the main cause of absenteeism from school (7).

It seems likely that the interaction between genetic factors (e.g. race, allergic predisposition, and family history) and environmental factors (e.g. outdoor and indoor allergens, air pollution, water, lifestyle, diet, and exposure to cigarette smoke) plays a role in the rising prevalence rate of atopic diseases (1). The exposure of children to cigarette smoke was found to have a large impact on the development of various disease states, including wheezing, asthma, and cough (8). In addition to the development of asthma, cigarette smoke is also implicated in the exacerbation of asthma (9). Another study has shown that living on farms and in environments free of urban pollution decreased the probability of asthma (10). It seems that in developing countries, asthma symptoms have weaker correlations with atopic disorders (6), while socioeconomic factors are involved in the correlation among all 3 disorders (6). Even though the usage of the ISAAC questionnaire has increased the similarity and comparability of various studies, many ambiguities regarding atopic diseases remain, including a determination of the effect of environmental risk factors on the development and exacerbation of atopic diseases, the possible presence of a causative relationship between asthma and allergic rhinitis or eczema, and trends regarding the exacerbation of atopic disorders, to name a few. Early diagnosis and timely management can prevent or diminish a great deal of the problems associated with these diseases. The objective of the present study was to investigate the prevalence of asthma, hay fever, and eczema, as well as environmental and demographic risk factors, among middle school students in the city of Tabriz.

Materials and methods

A cross-sectional study was carried out from October 2009 to December 2009 in the city of Tabriz in northwestern Iran. Assuming a significance level of P = 0.05, a confidence level of 95%, P = 0.08 and D = 0.014, a sample size of 1442 was estimated for simple random sampling. Considering the likelihood of missing cases, 1508 students were involved in this study.

The study sample included 1508 middle school students from 25 schools, selected by the proportional random sampling of 5 educational districts. To this end, the sample size was determined first and the number of boys and girls was calculated based on the total number of male and female students in the schools. The required number of boys and girls from public or nonprofit schools was then calculated. In the next stage, the required sample size for each educational district was determined in proportion to

the total number of students in each district. Schools were divided into 4 groups based on type (public or nonprofit) and the gender of their students. Finally, having determined the required number of students from each educational district, the number of boys and girls, and the ratio of public to nonprofit schools, the schools were randomly selected from each district so that for every 30 students required, a school was selected from those eligible for sampling. The number of sampled students from each grade was proportional to the number of students in that grade. In each classroom, if the required number of students for sampling was less than the total number of students in the classroom, the students were sampled by a systematic random technique according to alphabet letters. If the selected students were willing to cooperate, they filled out a standard questionnaire (ISAAC) in the presence of trained interviewers.

The validity and reliability of this questionnaire had been confirmed by researchers and authorities. The questionnaire consisted of 4 parts; in the first, information was collected on the demographic and environmental characteristics of the students. This was followed by standard criteria for the diagnosis of asthma symptoms, hay fever symptoms, and eczema symptoms, as three separate questionnaire sections. A final diagnosis was made by a specialist colleague according to the questionnaire results.

Descriptive statistics were used for description of data. Univariate and multiple logistic regressions were used for analysis of various demographic variables. A chi-square test was used to compare various symptoms of the 3 disorders in ecological areas of the city. The statistical analysis was performed using the SPSS 16 software package.

Results

Of 1508 students, 539 (35.7%) were in the first grade of the middle school, 462 (30.6%) were in the second grade, and 507 (33.6%) were in the third grade. Students of nonprofit schools constituted only 11.5% of all students in the sample. The number of male students included in our study was higher than that of female students (52.6% versus 47.4%). "Wheeze *ever*," "allergic rhinitis *ever*," and "itchy rash *ever*" were considered to be the main symptoms of asthma, hay fever, and eczema, respectively. CWP, WYP, and DAP were 3.7% (95% CI = 2.75-4.65), 2.9% (95% CI = 2.06-3.75), and 2% (95% CI = 1.29-2.71), respectively. Results for CARP were determined to be 17.1% (95% CI = 15.12-18.98), while the prevalence of ARYP was found to be 16.0% (95% CI = 14.15-17.85) and DHFP was established at 13.6% (95% CI = 11.87-15.33). Our survey also indicated that results for CRP, RYP, and DEP were 5.4% (95% CI = 4.26-6.54), 4.7% (95% CI = 3.63-5.77), and 7.3% (95% CI = 5.99-8.61), respectively. Table 1 shows the frequency of wheezing, allergic rhinitis, and nocturnal rash according to various demographic variables. The average age of participating students was 12.56 years (95% CI = 12.5-12.6) and the average age of the students' parents was 43.2 years (95% CI = 42.86-43.54) for fathers and 37.7 years (95% CI = 37.41-37.99) for mothers. The birth order of the students studied was 2.14 (95% CI = 2.03-2.25). The duration of breastfeeding for those with a history of being breastfed was, on average, 21.9 months (95% CI = 21.45-22.35). The average household size was found to be 4.8 (95% CI = 4.73-4.88). The daily average number of cigarettes smoked by the students' fathers was 11.3 (95% CI = 10.18-12.44) and the average duration of pet ownership among those students with pets was 19.8 months (95% CI = 14.4-25.2).

The presence of 2 naturally occurring geographic features, namely the Mehranrud River and the On ibn Ali mountains, has created a semiradial ecological context for the city. For this reason, the development of the city is from west to east, so that the eastern edge of the city is the main focus of new development. Accordingly, for the investigation of the effect of various geographical areas on the symptoms of atopic diseases, we divided the city of Tabriz into 3 parts: western, central, and eastern (Figure). The prevalence of the most prominent symptom of asthma, wheezing, was 4.9% (95% CI = 3.1-6.7) in the western part, 4.2% (95% CI = 2.3-6.1) in the central part, and 2.4% (95% CI = 1.16-3.64) in the eastern part. Other characteristics of wheezing attacks are shown in Table 2. Lifelong prevalence of asthma as diagnosed by a physician was 3.3% (95% CI = 0.05-4.7) in the western part, 1.4% (95% CI = 0.29-2.5) in the central part, and 1.4% (95% CI = 0.45-2.15) in the eastern part ($P < 0.049$). Nocturnal dry cough

Table 1. Prevalence of wheezing, allergic rhinitis, and nocturnal rush *ever* by demographical and environmental variables.

Variables	Total	Wheeze *ever*	Allergic rhinitis *ever*	Nocturnal rush *ever*
Sex	N (%)	N (%)	N (%)	N (%)
male	793 (52.6)	43 (5.4)	142 (17.9)	50 (6.3)
female	715 (47.4)	13 (1.8)	116 (16.2)	20 (2.8)
Year of middle school				
first	539 (35.7)	24 (4.5)	84 (15.6)	47 (5.0)
second	462 (30.6)	18 (3.9)	73 (15.8)	22 (4.8)
third	507 (33.6)	14 (2.8)	101 (19.9)	21 (4.1)
Type of school				
public	1335 (88.5)	48 (3.6)	230 (17.2)	67 (5.0)
nonprofit	173 (11.5)	8 (4.6)	28 (16.2)	3 (1.7)
Job of mother				
unskilled or skilled worker	130 (8.6)	4 (3.1)	26 (20.0)	6 (4.6)
office worker	31 (2.1)	1 (3.2)	7 (22.6)	2 (6.5)
housewife	1342 (89.3)	50 (3.7)	224 (16.7)	61 (4.5)
Education of father				
illiterate	122 (8.3)	5 (4.1)	21 (17.2)	7 (5.7)
primary school	354 (24.1)	11 (3.1)	50 (14.1)	16 (4.5)
middle school	360 (24.6)	13 (3.6)	63 (17.5)	14 (3.9)
high school & diploma	368 (25.1)	18 (4.9)	76 (20.7)	20 (5.4)
higher education	262 (17.9)	9 (3.4)	45 (17.2)	13 (5.0)
Education of mother				
illiterate	250 (16.8)	8 (3.2)	34 (13.6)	9 (3.6)
primary school	402 (27)	15 (3.7)	60 (14.9)	14 (3.5)
middle school	307 (20.6)	14 (4.6)	52 (16.9)	21 (6.8)
high school & diploma	361 (24.2)	14 (3.9)	77 (21.3)	18 (5.0)
higher education	169 (11.3)	4 (2.4)	31 (18.3)	8 (4.7)
Job of father				
professional	223 (15.5)	11 (4.9)	46 (20.6)	8 (3.6)
office worker or retired	397 (27.5)	11 (2.8)	78 (19.6)	28 (7.1)
skilled worker	603 (41.8)	20 (3.3)	90 (14.9)	27 (4.5)
unskilled worker	220 (15.2)	9 (4.1)	34 (15.5)	5 (2.3)
Breastfeeding				
yes	1400 (94.9)	50 (3.6)	240 (17.1)	62 (4.4)
no	75 (5.1)	4 (5.3)	17 (22.7)	7 (9.3)
Order of birth				
1	644 (42.8)	25 (3.9)	123 (19.1)	36 (5.6)
2	458 (30.5)	14 (3.1)	7 (15.9)	19 (4.1)
3	194 (12.9)	9 (3.6)	33 (17.0)	4 (2.1)
≥4	208 (13.8)	8 (3.8)	27 (13.0)	11 (5.3)
Family members living with				
father & mother	1453 (96.4)	52 (3.6)	247 (17.0)	67 (4.6)
father	9 (0.6)	0 (0.0)	1 (11.1)	1 (11.1)
mother	44 (2.9)	4 (9.1)	10 (22.7)	2 (4.5)
neither father nor mother	2 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Population density of house				
2-4	817 (54.2)	27 (3.3)	148 (18.0)	36 (4.4)
5-6	520 (34.5)	23 (4.4)	84 (16.2)	28 (5.4)
≥7	171 (11.3)	6 (3.5)	57 (15.8)	6 (3.5)
Keeping a pet				
yes	143 (9.5)	8 (5.6)	33 (23.1)	13 (9.1)
no	1363 (90.5)	47 (3.4)	224 (16.4)	57 (4.2)
Type of pet*				
1	68 (45)	2 (2.9)	21 (30.9)	5 (7.4)
2	49 (32.5)	3 (6.1)	12 (24.5)	5 (10.2)
3	34 (22.5)	3 (8.8)	3 (9.8)	4 (11.8)
Smoking father				
yes	464 (31.0)	20 (4.3)	87 (18.8)	27 (5.8)
no	1032 (69)	36 (3.5)	169 (16.4)	23 (4.2)
Presence of chronic disease+				
yes	85 (5.6)	49 (3.4)	236 (16.6)	60 (4.2)
no	1423 (94.4)	7 (8.2)	22 (25.9)	10 (11.8)
History of surgery				
yes	255 (16.9)	7 (2.7)	50 (19.6)	16 (6.3)
no	1253 (83.1)	49 (3.9)	208 (16.6)	54 (4.3)
History of hospitalization				
yes	73 (4.8)	7 (9.6)	15 (20.5)	13 (17.8)
no	1435 (95.2)	49 (3.4)	243 (16.9)	57 (4.0)
Deceased relatives++				
yes	76 (5.0)	3 (3.9)	14 (18.4)	3 (3.9)
no	1432 (95.0)	53 (3.7)	244 (17.0)	67 (4.7)

*1: birds, 2: dogs or cats, 3: fish and wild animals (mice, rabbits, squirrels, tortoises, porcupines)

+The mean of chronic disease: cardiovascular disorders, cancer, diabetes, renal disorders, and neurological diseases

++First-degree relatives: father, mother, sister, or brother

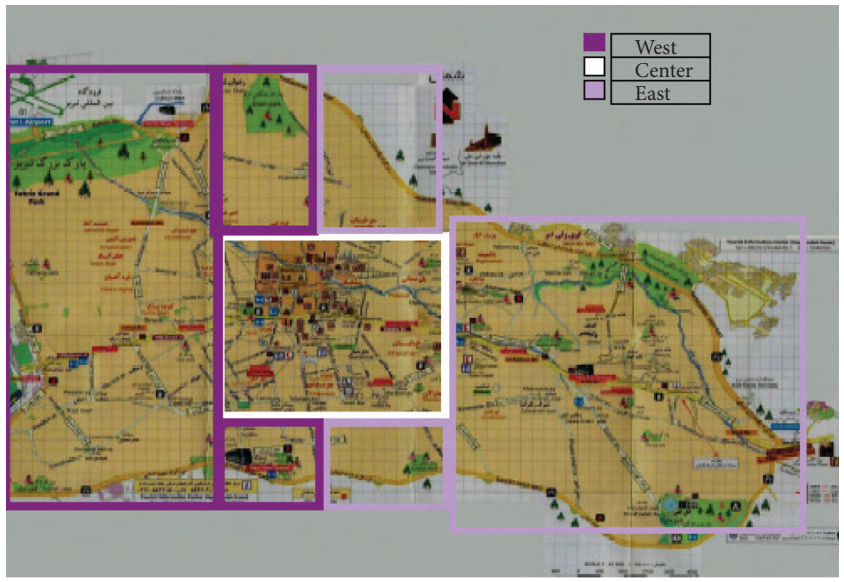

Figure. Classification Tabriz city based three ecological areas (western, central, and eastern parts of the city).

was also significantly less prevalent in the eastern part of the city than in the central and western parts (2.7% versus 6.5%) (95% CIs were, respectively, 4.3-8.6, 4.2-8.8, and 0.4-5.0; $P < 0.004$). The prevalence of "rhinitis allergic *ever*" in the 3 ecological areas was 16.1% (95% CI = 12.9-19.3), 19.5% (95% CI = 15.78-23.2), and 16.2% (95% CI = 13.2-19.8) for the western, central, and eastern parts of the city, respectively. The prevalence of "hay fever *ever*" in these 3 parts was 12.6% (95% CI = 9.7-15.52), 16.3% (95% CI = 12.8-19.8), and 12.4% (95% CI = 9.7-15.1), respectively. As for the prevalence of "itchy rash *ever*," the prevalence in the central part (9.3%; 95% CI = 6.6-12.1) was almost 4 times the prevalence in the western part (2.4%; 95% CI = 1.1-3.8) and 2 times that of the eastern part (4.9%; 95% CI = 3.2-6.7), a difference that was determined to be statistically significant ($P < 0.0001$). The prevalence of "eczema *ever*" was also significantly higher in the central part (10%; 95% CI = 7.2-12.8) when compared with the results for the western (4.9%; 95% CI = 3-6.8) and eastern (8.9%; 95% CI = 6.6-11.2) parts ($P < 0.012$). The presence of at least one of the symptoms of asthma, hay fever, or eczema was significantly more prevalent in the central part (26%; 95% CI = 21.9-30.1) than in the western (19.1%; 95% CI = 15.6-22.6) or eastern (19.6%; 95% CI = 16.4-22.8) parts ($P < 0.017$).

Comorbidity was observed between hospitalization for cardiac disease and asthma (with a relative frequency of 75%), between hospitalization for acute respiratory disease and allergic rhinitis (with a relative frequency of 37%), and between hospitalization for tonsillectomy and eczema (with a relative frequency of 22.2%). Univariate regression was used to test the relationship between wheezing and a number of variables, including gender, age, the type of school attended (public or nonprofit), grade (first, second, or third grade of middle school), parents' age, parents' occupation, parents' level of education, history and duration of breastfeeding, birth order, number of sisters, number of brothers, household size, the number of people with whom the student currently lives (both father and mother, only father, only mother, or neither father nor mother), the keeping of pets in the home either at present or in the past and its duration, cigarette smoking by the parents and the number of cigarettes smoked per day, a history of chronic disease diagnosed by a physician (including cardiac disease, renal disease, diabetes mellitus, and neurological disease), a history of surgical operation and the type of operation, a history of hospitalization (for any reason other than asthma, hay fever, or eczema), and the loss of a first-degree relative, including father, mother, brother, or

Table 2. The occurrence of symptoms of asthma, hay fever, and eczema on the basis of geographical distribution.

Symptoms	Citywide total for Tabriz	Western Tabriz	Central Tabriz	Eastern Tabriz	Significance
Cumulative wheeze	56 (3.7)				
	n = 1508				
Wheeze in the past year	46 (82.1)				
	n = 56				
Wheezing attacks in the past year	n = 37				
at all	5 (13.5)	3 (21.4)	1 (7.7)	1 (10.0)	
1-3 episodes	16 (43.2)	6 (42.9)	6 (42.6)	4 (40.0)	-**
4-12 episodes	6 (16.2)	1 (7.1)	4 (30.8)	1 (10.0)	
>12 episodes	10 (27.0)	4 (28.6)	2 (15.4)	4 (40.0)	
Episodes of sleep disturbance	n = 39				
never	24 (61.5)	9 (56.2)	10 (76.9)	5 (50)	
<1 per week	5 (12.8)	4 (25.0)	0 (0.0)	1 (10)	-**
>1 per week	10 (25.6)	3 (18.8)	3 (23.1)	4 (40)	
Asthma *ever**	30 (2.0)	16 (3.3)	6 (1.4)	8 (1.4)	0.049 (6.02)
Severe wheeze limiting speech in the past year	19 (48.7)				
	n = 39				
Exercise-induced wheeze in the past year	49 (3.3)				
	n = 1506				
Nocturnal cough in the past year	76 (5.0)				
Cumulative rhinitis	258 (17.1)				
	n = 1508				
Rhinitis in the past year	242 (93.8)				
	n = 258				
Rhinoconjunctivitis in the past year	176 (71.0)				
	n = 248				
Rhinitis affecting daily activities *ever*	n = 245				
at all	132 (53.9)	39 (50.6)	50 (63.3)	43 (48.3)	
severe	24 (9.8)	4 (5.2)	8 (10.1)	12 (13.5)	
Hay fever *ever**	205 (13.6)				
Cumulative itchy rash	81 (5.4)				
	n = 1508				
Itchy rash in the past year	71 (84.5)				
	n = 84				
Itchy flexural in the past year	72 (4.8)				
	n = 1508				
Number of bodily sites with eczeman = 1508					
1-3 sites	54 (77.1)	8 (66.7)	25 (73.5)	21 (87.5)	0.29 (2.46)
4-6 sites	16 (22.9)	4 (33.3)	9 (26.5)	3 (12.5)	
Clearance of rash in the past year	42 (59.2)				
Rash-induced sleep interruptions in the past year	n = 70				
never in the past year	45 (64.3)	6 (50.0)	25 (73.5)	14 (58.3)	
<1 night per week	12 (17.1)	3 (25.0)	3 (14.7)	4 (16.7)	-**
>1 night per week	13 (18.15)	3 (25.0)	4 (11.8)	6 (25.0)	
Eczema *ever**	110 (7.3)				
Experience with at least one symptom	321 (21.3)	94 (19.1)	112 (26.0)	115 (19.6)	<0.017 (8.2)

*Doctor-diagnosed, **One or more of the expected count < 5

sister. The only significant relationships were with gender (OR = 0.34, 95% CI = 0.17-0.67; P ≤ 0.002), a history of hospitalization (OR = 3.1, 95% CI = 1.3-7.6; P ≤ 0.012), and mother's age (OR = 3.7, 95% CI = 1.08-12.86; P ≤ 0.037), such that male students, those with a history of hospitalization, and students whose mothers were over 55 years of age were more likely to have asthma symptoms. In the multiple regression model, in the presence of variables with a maximum of 0.2 significance rejection probability (Table 3), the 2 variables of gender and mother's age remained significant (Table 3). It is noteworthy that the variable of mother's age was very scattered, and even after the elimination of 4 outlier data points, the stretch of the confidence interval was not much narrower. In the univariate regression test between allergic rhinitis and the demographic and environmental variables, students of educational districts 3 (OR = 1.52, 95% CI = 1.0-2.3; P ≤ 0.043) and 4 (OR = 1.55, 95% CI = 1.0-2.4; P ≤ 0.040) were more likely to have allergic rhinitis than students of district 1. Students whose mothers had a higher education level were more likely to have allergic rhinitis than students whose mothers were illiterate (OR = 1.7, 95% CI = 1.1-2.7; P ≤ 0.016). The chance of allergic rhinitis allergic was also higher for those students who kept pets at home (OR = 1.5, 95% CI = 1.0-2.3; P ≤ 0.046). Additionally, students who had a history of diagnosis of a chronic disease by a physician had a higher chance of allergic rhinitis (OR = 1.8, CI = 1.1-2.9; P ≤ 0.029). Third-grade students had a significantly higher chance of allergic rhinitis than first-grade students (Table 4), as did the students of educational district 4.

In univariate logistic regression tests, there was a higher chance of itchy rash for male students (OR = 2.34, 95% CI = 0.43-1.0; P ≤ 0.046), students with a history of keeping pets (OR = 2.29, 95% CI = 0.1.2-4.3; P ≤ 0.01), students with a history of diagnosis of a chronic disease (OR = 3.03, 95% CI = 1.5-6.2; P ≤ 0.002), students with a history of hospitalization (for any reason other than asthma, hay fever, or eczema) (OR = 5.2, 95% CI = 2.7-10.1; P ≤ 0.0001), and students in the western part of the city (OR = 3.3, 95% CI = 1.7-6.5; P ≤ 0.0001). Of the considered variables (Table 5), students with male sex, exposure to pets, a history of physician-diagnosed chronic disease, a history of hospitalization, attendance of public schools rather than nonprofit schools, and location in the central part of the city all showed a higher occurrence of disease (Table 5). The relationship among the 3 kinds of diseases was examined using a correlation test, and symptoms of all 3 diseases showed a highly significant correlation.

Table 3. Relationship between symptoms of wheezing and demographic and environmental variables.

Variables	Wheezing *ever*			Variables	Wheezing *ever*		
	OR	P-value	95% CI OR		OR	P-value	95% CI OR
Sex	0.39	0.046	0.16-0.99	**Breastfed**	0.52	0.28	0.16-1.7
Grade of middle school				**Keeping a pet**	1.56	0.36	0.6-4.1
first	1	-	-	**Having a chronic disease***	0.68	0.52	0.21-2.2
second	1.5	0.36	0.6-3.6	**History of hospitalization****	2.46	0.11	0.81-7.5
third	0.83	0.70	0.32-2.2	**District of education**			
Job of father				1	1	-	-
professional	1	-	-	2	0.51	0.51	0.5-3.7
office/retired	0.395	0.11	0.13-1.2	3	0.25	0.07	0.25-1.1
skilled worker	0.813	0.68	0.31-2.1	4	0.99	0.1	0.998-2.8
unskilled worker	0.654	0.52	0.18-2.35	5	0.49	0.33	0.496-2.1
Age of mother				**Ecological distribution**			
≥50	1	-	-	west	1	-	-
35-49	0.20	0.02	0.05-0.80	center	1.1	0.89	0.39-2.9
25-34	0.27	0.038	0.08-0.93	east	0.93	0.92	0.22-3.9

*The mean of chronic disease: cardiovascular disorders, cancer, diabetes, renal disorders, and neurological diseases
**History of hospitalization for cardiovascular disorders, cancer, diabetes, renal disorders, and neurological diseases

Table 4. Relationship between symptoms of allergic rhinitis and demographic and environmental variables.

Variables	Allergic rhinitis *ever*			Variables	Allergic rhinitis *ever*		
	OR	P-value	95% CI OR		OR	P-value	95% CI OR
Smoking of father	1.19	0.25	0.89-1.6	**Geographical distribution**			
Grade of middle school				west	1		
1	1	-	-	center	1.2	0.42	0.79-1.8
2	1.1	0.78	0.74-1.49	east	1.1	0.77	0.65-1.8
3	1.5	0.03	1.1-2.0	**Birth order**			
Breastfed	0.73	0 .27	0.41-1.28	**1**			
Keeping a pet	1.5	0.07	0.97-2.3	**2-3**	0.85	0.27	0.63-1.1
Having a chronic disease*	1.6	0.10	0.92-2.7	**≤4**	0.74	0.23	0.45-1.2
District of education	1.1		0.85-1.5	**Education status of mother**			
1	1		-	illiterate			
2	1.03	0.94	0.51-2.07	primary school	1.04	0.87	0.64-1.7
3	1.39	0.23	0.83-2.18	middle school	1.16	0.58	0.69-1.9
4	1.59	0.04	1.02-2.47	high school & diploma	1.39	0.21	0.83-2.3
5	1.1	0.71	0.64-1.9	higher education	1.06	0.84	0.58-1.9

* The mean of chronic disease: cardiovascular disorders, cancer, diabetes, renal disorders, and neurological diseases

Table 5. Relationship between symptoms of eczema and demographic and environmental variables.

Variables	Itchy rash *ever*			Variables	Itchy rash *ever*		
	OR	P-value	95% CI OR		OR	P-value	95% CI OR
Sex	0.47	0.013	0.261-0.85	**Type of school**	0.2	0.031	0.05-0.87
Smoking of father	1.28	0.358	0.75-2.18	**Geographical distribution**			
Breastfed	0.59	0.253	0.24-1.46	west			
Keeping a pet	2.0	0.042	1.3-3.9	center	2.78	0.005	1.35-5.7
Having a chronic disease	2.46	0.028	1.1-5.5	east	1.7	0.144	0.83-3.67
History of hospitalization	3.01	0.005	1.4-6.5	**Birth order**			
History of surgery	1.5	0.20	0.81-2.8	1			
Job of father				2-3	0.597	0.079	0.34-1.1
professional				≤4	1.0	0.930	0.49-2.18
office worker or retired	2.0	0.11	0.86-4.74				
skilled worker	1.09	0.85	0.46-2.56				
unskilled worker	0.6	0.41	0.18-2.0				

Discussion

As with other parts of the world, the prevalence of allergic diseases in Asia has a wide distribution and appears to be increasing (14). In the studied students, CWP, WYP, and DAP were 3.7%, 2.9%, and 2%, respectively. In comparison, a similar study conducted in Tabriz in 2001 on students 13-14 years old reported the values to be 8%, 4.2%, and 1.45%, respectively (14). It can be seen that in the present study, the cumulative and periodic prevalence of wheezing has decreased while the diagnosis of asthma by physicians has increased. A variety of similar national and international reports released in recent years are summarized in Table 6.

According to current references, the prevalence of asthma symptoms and the diagnosis of asthma are higher than the estimations of the current study (Table 6). CARP, ARYP, and DHFP were 17.1%, 16.0%, and 13.6%, respectively. In the previously mentioned study, these indices were 24.2%, 20.3%, and 5.9%, respectively, among Tabriz students 13-14 years old (14). This shows a decrease in the prevalence of allergic rhinitis and an increase in the prevalence of hay fever. Compared with the information presented in national reports, ARYP had a higher prevalence in our study than in any other, excluding the students in Tehran. CRP, RYP, and DEP were 5.4%, 4.7%, and 7.3%, respectively. The current results regarding eczema are almost equal to results from locations like Hong Kong and Croatia (2).

In the current study, the symptoms of asthma, allergic rhinitis, and eczema were more prevalent in boys than in girls; using the multiple regression model, boys were found to be more likely to have rhinitis or eczema, although gender seemed to have no effect on the prevalence of asthmatic symptoms. Reviewing similar studies from around the world has shown that the prevalence of atopic diseases is higher in boys than in girls in most cases (16,22,23). The difference between the 2 sexes in terms of the chance of having such a disease was determined to be statistically significant in some studies (10,16) and insignificant in some other studies (4,18). In the current study, after the consideration of demographic, social, and environmental characteristics, the statistical correlation between eczema and keeping pets (at the time of sampling) remained significant. Several reports have shown a significant correlation between exposure to pets (specifically cats) and asthma, allergic rhinitis, and eczema, mostly indicating a positive relationship (10). However, in some studies, no relationship has been found

Table 6. Worldwide comparison of atopic syndrome.

Year	Country(city)	Age group	Prevalence of symptoms									Reference
			Asthma			Eczema			Hay fever			
			CWP	WYP	DAP	CARP	ARYP	DHFP	CRP	RYP	DEP	
2005	Teheran (Iran)	10-14		31.7	8.4							11
2007	Babol (northern Iran)	6-13	13	4.4		28.3	7.6	5.8	5.8	5.8	6.6	12
2006	Gorgan (northern Iran)	12-13	30.5	20.1	7	25.5	16	3.4				13
2001	Zarrin-shahr (Esfahan-Iran)	13-14	5.9	1.2		19.9	10.2	9.2	9.2	9.2	3.6	15
2002	Rasht (northern Iran)	10-14			4.1	28.3	7.6	5.8	5.8	5.8		16
2001	Zagreb	10-14	13					12	12	12	7.8	2
2005	Latin America	13-14	17	19.9	8							17
2001	Singapore	12-15	25.1		11.9			27.4	27.4	27.4	5.8	18
2006	Northern Croatia	10-14	11.9	5		12	10.9				5	19
2006	Brazil	13-14			13.6			14.6	14.6	14.6	8.9	20
2009	Berlin	13					24					21

between the 2 variables (24). With regard to the multitude of reports on the relationship between atopic diseases and exposure to pets, it is possible that confounding variables could be influential. The effect of breastfeeding on atopic diseases showed no statistically significant relationship in our research. In some studies, breastfeeding has clearly decreased the risk of developing asthma (25-27), while in others, there has been no relationship proven between asthma or rhinitis and breastfeeding (18).

In the current study, CWP, DAP, and the presence of nocturnal dry coughs increased from east to west in the city of Tabriz. The higher value of DAP in the western part in comparison with the central and eastern parts was found to be statistically significant. As for the RAP and DHFP, the central part had higher values compared with the eastern and western parts. For CARP, prevalence in the central part was almost 4 times that in the western part and 2 times the prevalence in the eastern part, with a difference that was discovered to be statistically significant. The prevalence rate of "eczema *ever*" was also significantly higher in the central part than in the eastern or western parts.

In some studies, the living environment of individuals was discovered to have a significant influence on the occurrence or severity of these symptoms (10,19). No significant relationship was found between household size and atopic diseases in this study, comparable to the results of other studies (10,18). However, similar to other studies, the prevalence of asthma was higher in students who had fathers who smoked (28). Nevertheless, a multiple regression model showed that the smoking habits of the father do not affect the chance of atopic diseases in the students, while most studies have shown an active or inactive statistically significant relationship between asthma and smoking (19). Some other studies, however, reported no relationship between smoking and asthma (19).

It should be noted that there have been many differences in the manner of control for confounding variables. In a multiple regression test, an advanced maternal age increased the chance for the symptoms of asthma. This result was obtained after controlling for potential confounding variables, including breastfeeding. Regarding the occupation or education level of parents, a multiple logistic regression model showed no statistically significant relationship. In some other studies, no relationship was found between asthma and socioeconomic status (4,10). In the current study, according to the multiple regression model, a history of hospitalization increased the chance of eczema, just as the occurrence of a physician-diagnosed chronic disease (other than atopic diseases) increased the chance of asthma and allergic rhinitis. In the current study, comorbidity was established between hospitalization for cardiac disease and asthma, between hospitalization for acute respiratory disease and rhinitis, and between hospitalization for tonsillectomy and eczema. As for the high prevalence of these diseases during infectious respiratory diseases, it should be noted that allergens can also be infectious agents. As for the comorbidity between atopic diseases, all 3 disorders had significant correlations with each other. There are many reports regarding the causative relationship between asthma and allergic diseases, and their comorbidity has been proven by numerous studies (10).

Conclusion

Even though advances in the sensitivity and accuracy of medical diagnoses may be implicated in the upward trend in the prevalence rate of asthma and hay fever, exacerbation of asthma or hay fever symptoms should also be considered as a possible explanation, causing increased probability for diagnosis of the disease. The small difference between CARP and ARYP figures in the present study, in comparison with those found in existing studies, may be indicative of the rapid and substantial recent increase in the 12-month prevalence rate of allergic rhinitis. Faced with the presence of various demographic, environmental, and even ethnic variables, an identification of the causative factors of the higher prevalence of asthma in the western part of the city compared to the central and eastern parts seems to be a challenging but necessary task. An ecological survey conducted in this geographical region and even in adjacent countries could be very revealing. Even though an in-depth study of comorbidity between chronic diseases and the symptoms of atopic diseases is not feasible in the

current study due to the limitation of the sample size, new and useful insights may result from some of the statements presented, such as the interactions between the side effects of drugs and atopic diseases. Various opinions have been presented in previous studies regarding the relationship between atopic diseases, and it seems that these diseases may have some effect on each other.

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