Research Article

Asthma and allergies among adolescents: comparison of symptoms and prevalence between urban and rural settings

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Abstract

Background: Asthma and allergies have developed into the most popular chronic diseases in children. Little information is available about the prevalence of these diseases in Saudi Arabia, especially among the adolescents and in rural areas. So, our aim is to describe the prevalence of asthma, rhinitis, and eczema symptoms in the rural and urban areas from Riyadh region–Saudi Arabia.

Objective: To assess the prevalence of allergic diseases (bronchial asthma, rhinitis, and eczema) in adolescents, compare the prevalence of allergic diseases between the adolescents living in the urban area and those living in the rural area, and assess the relationship between asthma and other allergic diseases.

Materials and Methods: A cross-sectional survey was conducted in the intermediate and high schools in the Riyadh region, Saudi Arabia. The Arabic version of the International Study of Asthma and Allergies in Children (ISAAC) questionnaire tool was distributed to 568 students in the rural area and 556 students in the urban area. The factors such as lifetime, 12 months, and the severity prevalence were determined for asthma, rhinitis, and eczema symptoms.

Result: The mean age of the participants was 16.5 years. The prevalence of lifetime wheeze, asthma diagnosed by physician, and wheezing during the last 12 months was 19.2%, 23.1%, and 10.3%, respectively. There was no significant difference in the prevalence of lifetime wheeze between the adolescents of the rural (19%) and urban (19.4%) ($p = 0.86$) areas. The prevalence of rhinitis symptoms in the last 12 months among the students was 28.1%, with no significant difference between the rural and urban regions. Allergic rhinitis was highly associated with lifetime wheeze [odds ratio (OR) = 2.94, $p < 0.001$], asthma diagnosed by physician (OR = 2.73, $p < 0.001$), and exercise-induced wheeze (OR = 3.55, $p < 0.001$).

Conclusion: The prevalence of asthma, rhinitis, and eczema in Saudi Arabia is elevated, although it is near to the reported prevalence ranges from many countries. Asthma, rhinitis, and eczema symptoms show a similar prevalence between the adolescents of the rural and urban areas. Asthma symptoms are strongly associated with rhinitis and eczema symptoms.

KEY WORDS: Asthma, allergy, adolescent, rhinitis, eczema

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Introduction

The prevalence of bronchial asthma and allergies has increased significantly in the last few decades among the children and adolescents.[1] Asthma has become the most common chronic disease among children and is one of the important causes of absence from school and of reduced participation in sport and other activities.[2,3]

The studies have shown that the incidence and severity of allergic diseases, especially rhinitis and asthma in urban areas, have increased.[4] The causes of this increase are not well-known but may be related to the factors such as poor air quality from pollution,[5,6] indoor allergen exposure,[7] high stress lifestyles,[8] and dietary habits[9] in the risk of developing allergic rhinitis (AR), asthma, or both in urban areas.

Some of the factors being investigated as protective against the onset of asthma and allergic diseases include an early exposure to infectious agents and/or endotoxins (Hygiene theory),[10] to be born and growing up in a rural area,[11] and to have been long-term breastfed.[12,13]

Considerable evidence indicates that there is a significant regional variation in the prevalence of asthma.[14] Many evidences worldwide show a decreased prevalence of asthma and other atopy among those who are living in farms or rural areas.[15,16]

The prevalence of bronchial asthma in the Kingdom of Saudi Arabia (KSA) was investigated in multiple studies. Alfaryeh and his group showed an increase in the prevalence from 1986 to 1995; the increase was from 8% to 23%, respectively. Hejazi et al. reported a significant difference in prevalence of asthma symptoms among the school-age children between those who are living in urban areas compared with those living in the rural areas, 13.9% vs. 8%. The studies evaluating the prevalence of asthma and allergic diseases among the children in KSA in rural area when compared with urban area are rare. The aim of this study is to evaluate if school-aged adolescents living in a rural area are protected against the development of symptoms of asthma, rhinitis, and atopic eczema when compared with those living in an urban area in the same region of the country.

Materials and Methods

The objective of the study is to compare the prevalence of allergic diseases (asthma, rhinitis, and eczema) and their relationship between school-aged adolescents living in the urban area (city) and those who are living in rural area (farm or villages).

A cross-sectional survey using the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire was conducted in the intermediate and high schools in the city of Riyadh, which represent the urban samples, and in the subgovernorates (Marakiz) of Alkharj city, which represent the rural samples, both are located at the central region of KSA. Marakiz contains a lot of farms that produce dates, vegetables (including carrots, cucumbers, tomatoes, and lettuce), and fruits (including oranges, melons, and grapes).

The total sample size is 1,200, both male and female students, aged 13 to 22 years were included. Schools and students were selected using a two-stage sampling method. In the first stage of the sampling, a total of 23 schools, 11 in Riyadh city and 12 in subgovernorate, were selected randomly. During the second sampling stage, a total of 47 classes were selected randomly from each school according to the student's number.

A standardized validated research instrument, ISAAC questionnaire, has been used.[17] It was translated to Arabic language and then to English by different teams at Health Research Section, King Abdullah International Medical Research Center, National Guard Health Affairs, Riyadh. The ISAAC questionnaire was developed to determine the prevalence of asthma, rhinitis, and eczema in various locations.

The asthma symptoms were defined as self-reported symptoms of wheezing or whistling in the chest. Severe asthma symptoms were considered present if children with current asthma symptoms reported four or more attacks of wheeze, being woken by wheeze at one or more nights per week, or wheezing severe enough to limit speech to only one or two words at a time between two breaths. Exercise-induced wheeze and cough variant asthma were considered. Rhinitis symptoms were defined as self-reported problems of sneezing, runny or blocked nose, without a cold or influenza. Rhinoconjunctivitis symptoms were considered present if the participants reported rhinitis symptoms accompanied by itchy watery eyes. Severe AR symptoms were defined as rhinoconjunctivitis symptoms interfering with daily activities.[18] Itchy rash was considered if the participant reported an itchy rash, which prevailed on and off for at least 6 months. The current symptoms of eczema were defined as the presence of an itchy rash in the last 12 months that affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears, or eyes. Severe eczema symptoms were considered present if eczema symptoms affected sleep (1 or more nights per week).

The students completed the questionnaires in the classrooms, and the data were entered and analyzed using SPSS software, version 20. All the variables were summarized and reported using descriptive statistics for the risk factors [e.g., area of residence (urban or rural), rhinitis symptoms, and hay fever]. The χ^2-test was calculated, with a $p \leq 0.05$ considered significant. An odds ratio (OR) with a corresponding 95% confidence interval (CI) was calculated for the relationship between asthma and atopic diseases.

The study was approved by the King Abdullah International Medical Research Center and the Department of Family Medicine Research Committee, National Guard Health Affairs, Riyadh. Moreover, the study was conducted with permission from the local schools administration. An oral consent was provided by the students after the aim of the study was clarified.

Result

A total of 1,124 of the 1,200 questionnaires were completed with a response rate of 93.7%; the nonresponse was owing to the incomplete data. The sample was divided equally between the urban and rural areas. The mean age of the

participants was 16.5 years (SD ± 1.24). The prevalence of lifetime wheeze, wheezing during the last 12 months, and/or physician-diagnosed asthma was 19.2%, 10.3%, and 23.1%, respectively. The prevalence of exercise-induced wheeze and night cough in the last 12 months was 22.4% and 25.3%, respectively [Table 1]. There was no significant difference in the prevalence of lifetime wheeze between the rural (19%) and urban (19.4%) areas ($\chi^2 = 0.03$, $p = 0.86$). However, night cough prevalence in the last 12 months was more in urban (29.5%) than the rural (21.1%) areas ($\chi^2 = 10.4$, $p = 0.001$). In assessing the severity of asthma symptoms, the majority of students (60.3%) experienced fewer than three wheezing attacks in the last 12 months [Table 2]. Around 10.3% students showed 12 or more wheezing attacks; regarding sleep disturbances, 19% were awakened more than one night per week owing to wheezing. The prevalence of speech-limiting wheeze was 30.9% [Table 2]. The prevalence\\ of present rhinitis symptoms (sneezing, rhinorrhea, irritation, and nasal blockage) in the last 12 months among the students was 28.1%, which was more in urban (30.2%) than the rural (26.1%) areas, ($p = 0.127$). The prevalence of rhinitis symptoms among the students with lifetime wheeze, physician-diagnosed asthma, and exercise-induced wheeze was 60.2%, 57.7%, and 62.7%, respectively [Table 3]. Rhinitis symptoms were strongly linked with lifetime wheeze (OR = 2.94, $p < 0.001$), physician-diagnosed asthma (OR = 2.73, $p < 0.001$), and exercise-induced wheeze (OR = 3.55, $p < 0.001$) [Table 4]. The prevalence of eczema in students with lifetime wheeze, physician-diagnosed asthma, and exercise-induced wheeze was 16.7%, 12.3%, and 14.3%, respectively. Eczema was strongly linked with lifetime wheeze (OR = 4.84, $p < 0.001$), physician-diagnosed asthma (OR = 2.89, $p < 0.001$), and exercise-induced wheeze (OR = 3.87, $p < 0.001$) [Table 4].

Discussion

In this study, we have measured the prevalence of asthma, rhinitis, and eczema among the school-age adolescents and compared the prevalence of asthma and other allergic disease between the students who resided in the rural areas with those in the urban areas and the relationship between asthma and rhinitis symptoms and eczema. Our study has showed that the prevalence of lifetime wheeze, wheeze during the last 12 months, and physician-diagnosed asthma was 23.1%, 10.3%, and 19.2%, respectively. The prevalence of exercise-induced wheezing and night coughing during the last 12 months was 22.4% and 25.3%, respectively. In KSA, the prevalence of asthma is variable according to the geographical region and age (8%–24%). The study carried out by Alghobain et al.[19] used the same questionnaire, at a similar age group and at the same region similar to ours and found almost similar results to our study in most of the variables such as, lifetime wheeze (25.3% vs. 23.1%), physician-diagnosed asthma (19.6% vs. 19.2%), exercise-induced wheezing (20.2% vs. 22.4%), and night coughing during the last 12 months (25.7% vs. 25.3%), which may suggest that the prevalence of asthma has reached a plateau in KSA.

In the Gulf countries, the prevalence of asthma diagnosed by physician was reported to be lower than that reported by our study—6.8% in Kuwait (2000), 13% in the United Arab Emirates (2000), and 10.6% in Oman (2008), but similar to our study in Qatar (19.8%; 2006). The prevalence of asthma diagnosed by physician ranged from 3% to 29% in the adolescent age group. The prevalence reported in this study was within the range reported for national and global prevalence references.

Living in rural areas (farms and villages) or areas with less traffic flow is not protective against atopic diseases as shown in our study with no significant difference between rural and urban in lifetime wheeze, the last 12 months wheeze, physician-diagnosed asthma, exercise-induced wheeze, current rhinitis symptoms, and current eczema symptoms, which may be explained by the similarity in geographical, weather, and environmental conditions in both the areas and owing to the close distance between them. In contrast, significant differences were observed in our study for night cough; its prevalence was statistically significantly higher in the city (29.5%) than that in the rural (21.1%) areas.

Downs et al.[20] also did not find a protective effect for living in the farms among children living in a primary crop farming region. In contrast to the study carried out by Hejazi et al.,[21] which showed two- to threefold difference in asthmatic symptoms between the urban and rural residents. The same finding was reported in a cross-sectional survey of children in Austria, Germany, and Switzerland, which revealed a decrease in the prevalence of asthma, hay fever, and atopic sensitization among the children living in farms.[22]

Regarding the prevalence of the current rhinitis symptoms in the last 12 months, it was 28.1%, which is near to the prevalence of AR among the Saudi children according to the study done by Sobki and Zakzouk[23] and Alfaryah et al.[24] These studies showed a prevalence of around 26.51% and 25%, respectively. Other global studies estimated similar figures; for example, Meltzer et al.[19] suggested that AR affects 25% of the general population and 40% of children. Another study done by Skoner et al.[21] showed a lower prevalence from 3% to 19%. Our study revealed that the rhinitis symptoms were strongly linked with lifetime wheeze, physician-diagnosed asthma, and exercise-induced wheeze. This is similar to the findings of the study carried out by Alghobain et al.[19] The connection between the AR and asthma has been the subject of many epidemiological investigations that have shown an important overlap between both the diseases. Both the diseases frequently coexist in the same patients, with asthma present in 20%–50% of patients with AR and rhinitis present in up to 80% of patients with asthma.[25] This is supported by the fact that both of them share the same pathophysiological symptoms, where the allergen-specific IgE antibodies together with the mast cells and basophils play a central role in initiating the inflammatory cascade. In addition, two major mechanisms have been demonstrated to contribute to the

Table 1: The frequency of symptoms of asthma, rhinitis, and eczema for all the subjects

Variables	N	%
Wheeze ever	216	19.2
Wheeze in the last 12 months	116	10.3
Four or more attacks of wheeze in the last 12 months	89	3.1
Sleep disturbance from wheeze. One or more nights a week in the last 12 months	32	2.85
Speech limited by wheeze in the last 12 months	34	3.02
Asthma ever	260	23.1
Wheeze during or after exercise in the last 12 months	252	22.4
Night cough in the last 12 months	284	25.3
Nose symptoms ever	438	39
Nose symptoms in the last 12 months	284	25.3
Nose and eye symptoms in the last 12 months	182	16.2
Nose symptoms affecting activities a lot in the last 12 months	94	8.3
Hay fever ever	277	24.6
Rash ever	72	6.4
Rash in the last 12 months	40	3.6
Flexural rash	225	7.8
Eczema ever	72	6.4

Table 2: The frequency of wheeze and associated symptoms among the study groups

Symptoms	Rural	Urban	All	
	No. (%)	No. (%)	No. (%)	*P* value
Lifetime wheeze	108 (19)	108 (19.4)	216 (19.2)	0.88
Wheeze in the last 12 months	56 (9.9)	60 (10.8)	116 (10.3)	0.625
Exercise-induced wheeze	124 (21.8)	128 (23)	252 (22.4)	0.342
Night cough in the last 12 months	120 (21.1)	164 (29.5)	284 (25.3)	0.001
Itchy nose and eyes	218 (38.4)	220 (39.6)	438 (39)	0.71
Itchy nose and eyes in the last 12 months	148 (26.1)	168 (30.2)	316 (28.1)	0.13
Physician-diagnosed asthma	126 (22.2)	134 (24.1)	260 (23.1)	0.479
Physician-diagnosed eczema	38 (6.7)	34 (6.1)	72 (6.4)	0.72
Physician-diagnosed hay fever	34 (6)	26 (4.7)	60 (5.3)	0.23

Table 3: The frequency of symptoms in those with wheeze in the last year among the study groups

Symptoms	Rural	Urban	Total
	N (%)	N (%)	N (%)
Number of attacks			
Non	12 (21.4)	6 (10)	18 (15.5)
1–3	32 (57.1)	38 (63.3)	70 (60.3)
4–12	6 (10.7)	10 (16.7)	16 (13.8)
> 12	6 (10.7)	6 (10)	12 (10.3)
Total	56 (100)	60 (100)	116 (100)
Speech-limiting wheeze	24 (42.9)	10 (16.7)	34 (29.3)
Waking at night			
Not awakened	26 (46.4)	22 (36.7)	48 (41.4)
Once week	18 (32.1)	18 (30)	36 (31)
More than once a week	12 (21.4)	20 (33.3)	32 (27.6)
Total	56 (100)	60 (100)	116 (100)

Table 4: Asthma symptoms in relation to rhinitis and eczema symptoms

	Rhinitis symptoms				Eczema symptoms			
	Prevalence No. (%)	P value	Odds Ratio	Confidence interval	Prevalence No. (%)	P value	Odds Ratio	Confidence interval
Lifetime wheeze	130 (60.2)	<0.001	2.94	(2.2–3.99)	36 (16.7)	<0.001	4.84	(2.97–7.9)
Physician diagnosed asthma	150 (57.7)	<0.001	2.73	(2.05–3.62)	32 (12.3)	<0.001	2.89	(1.78–4.71)
Exercise-induced wheeze	152 (62.7)	<0.001	3.55	(2.65–4.76)	36 (14.3)	<0.001	3.87	(2.38–6.29)

increased number of eosinophils in the inflamed airways of allergic subjects, recruitment and persistence of inflammatory cells into the airways, and the presence of bone marrow progenitors in the inflamed airway tissues.[26] Regarding the AR, the prevalence variation between the urban and rural areas was shown in this study, which revealed no significant variation in the prevalence of atopic diseases, with a slightly higher value in the city. Our study included only male students. The female subjects were not included in this study because of the difficulties in accessing the girls' school, especially in the rural regions. The translation of some terms to Arabic language, for example, wheeze, hay fever, itchy rash, etc., may not have been fully understood by students leading to inaccurate answers, and finally, subjective appreciation of allergic disease symptoms (wheeze, runny or blocked nose, and itchy rash) might have influenced the responses.

Conclusion

The prevalence of asthma, rhinitis, and eczema is high in this region but within the reported prevalence ranges from many other studies, nationally and internationally. There is no difference between the rural and urban areas in the prevalence of asthma, rhinitis, and eczema symptoms. Asthma and asthma-related symptoms are associated with a high rate of rhinitis symptoms and eczema.

References

1. Omran M, Russell G. Continuing increase in respiratory symptoms and atopy in Aberdeen schoolchildren. BMJ 1996;312 (7022):34.
2. Hill RA, Standen PJ, Tattersfield AE. Asthma, wheezing, and school absence in primary schools. Arch Dis Child 1989;64(2):246–51.
3. Lobo FA, Almada-Lobo B. Quality of life in asthmatic outpatients. J Asthma 2008;45(1):27–32.
4. Call RS, Smith TF, Morris E, Chapman MD, Platts-Mills TA. Risk factors for asthma in inner city children. J Pediatr 1992;121(6):862–6.
5. D'Amato G, Liccardi G, D'Amato M. Environmental risk factors (outdoor air pollution and climatic changes) and increased trend of respiratory allergy. J Investig Allergol Clin 2000;10(3):123–8.
6. Kemeny DM. The effects of pollutants on the allergic immune response. Toxicology 2000;152(1–3):3–12.
7. Gelber LE, Seltzer LH, Bouzoukis JK, Pollart SM, Chapman MD, Platts-Mills TA. Sensitization and exposure to indoor allergens as risk factors for asthma among patients presenting to hospital. Am Rev Respir Dis 1993;147(3):573–8.
8. Miller BD, Wood BL. Emotions and family factors in childhood asthma: psychobiologic mechanisms and pathways of effect. Adv Psychosom Med 2003;24:131–60.
9. Wehrmeister FC, Menezes AM, Cascaes AM, Martínez-Mesa J, Barros AJ. Time trend of asthma in children and adolescents in Brazil, 1998–2008. Rev Saude Publica 2012;46(2):242–50.
10. Farooqi IS, Hopkin JM. Early childhood infection and atopic disorder. Thorax 1998;53(11):927–32.
11. von Mutius E. Asthma and allergies in rural areas of Europe. Proc Am Thorac Soc 2007;4(3):212–6.
12. Chulada PC, Arbes SJ Jr, Dunson D, Zeldin DC. Breast-feeding and the prevalence of asthma and wheeze in children: analyses from the Third National Health and Nutrition Examination Survey, 1988–1994. J Allergy Clin Immunol 2003;111(2):328–36.
13. Midodzi WK, Rowe BH, Majaesic CM, Saunders LD, Senthilselvan A. Early life factors associated with incidence of physician-diagnosed asthma in preschool children: results from the Canadian Early Childhood Development cohort study. J Asthma 2010;47(1):7–13.
14. Pearce N, Aït-Khaled N, Beasley R, Mallol J, Keil U, Mitchell E, et al. Worldwide trends in the prevalence of asthma symptoms: phase III of the International Study of Asthma and Allergies in Childhood (ISAAC). Thorax 2007;62(9):758–66.
15. Keeley DJ, Neill P, Gallivan S. Comparison of the prevalence of reversible airways obstruction in rural and urban Zimbabwean children. Thorax 1991;46(8):549–53.
16. Yemaneberhan H, Bekele Z, Venn A, Lewis S, Parry E, Britton J. Prevalence of wheeze and asthma and relation to atopy in urban and rural Ethiopia. Lancet 1997;350(9071):85–90.
17. Asher M, Keil U, Anderson H, Beasley R, Crane J, Martinez F, et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. Eur Respir J 1995;8(3): 483–91.
18. Ait-Khaled N, Pearce N, Anderson HR, Ellwood P, Montefort S, Shah J, et al. Global map of the prevalence of symptoms of rhinoconjunctivitis in children: the international study of asthma and allergies in childhood (ISAAC) phase three. Allergy 2009; 64(1):123–48.
19. Meltzer EO. Role for cysteinyl leukotriene receptor antagonist therapy in asthma and their potential role in allergic rhinitis based on the concept of "one linked airway disease". Ann Allergy Asthma Immunol 2000;84(2):176–85.
20. Downs S, Marks G, Mitakakis T, Leuppi J, Car N, Peat J. Having lived on a farm and protection against allergic diseases in Australia. Clin Exp Allergy 2001;31(4):570–5.

21. Skoner DP. Allergic rhinitis: definition, epidemiology, pathophysiology, detection, and diagnosis. J Allergy Clin Immunol 2001;108(Suppl 1):S2–8.
22. Riedler J, Braun-Fahrländer C, Eder W, Schreuer M, Waser M, Maisch S, et al. Exposure to farming in early life and development of asthma and allergy: a cross-sectional survey. Lancet 2001;358(9288):1129–33.
23. Sobki SH, Zakzouk SM. Point prevalence of allergic rhinitis among Saudi children. Rhinology 2004;42(3):137–40.
24. Al Frayh AR, Shakoor Z, Gad El Rab MO, Hasnain SM. Increased prevalence of asthma in Saudi Arabia. Ann Allergy Asthma Immunol 2001;86(3):292–6.
25. Demoly P, Bousquet J. The relation between asthma and allergic rhinitis. Lancet 2006;368(9537):711–3.
26. Bousquet J, Vignola AM, Demoly P. Links between rhinitis and asthma. Allergy 2003;58(8):691–706.
27. Mohammed O Al Ghobain, Mohamad S Al-Hajjaj and Mohamad S Al Moamary. Asthma prevalence among 16- to 18-year-old adolescents in Saudi Arabia using the ISAAC questionnaire. BMC Public Health 2012, 12:239 doi:10.1186/1471-2458-12-239.
28. Hijazi N(1), Abalkhail B, Seaton A. Asthma and respiratory symptoms in urban and rural Saudi Arabia. Eur Respir J. 1998 Jul;12(1):41–4.

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