
Prevalence of asthma, allergic rhinitis, and eczema in 13- to 14-year-old children in Kuwait: an ISAAC study

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Objectives: To determine the prevalence of asthma and allergic diseases in 13 to 14 years old children in Kuwait.

Design: Supervised self-administered written and video questionnaires of the international study of asthma and allergies in childhood (ISAAC).

Subjects: Students at third and fourth years from 40 intermediate level schools chosen randomly from across Kuwait.

Results: 3,110 students were surveyed. The prevalence rates (95% CI) in the written questionnaire for wheeze ever, current wheeze (within the last 12 months), and physician diagnosis of asthma are 25.9% (24.5 to 27.4), 16.1% (15.8 to 17.4), and 16.8% (15.5 to 18.1) respectively. The prevalence rates (95% CI) for symptoms of allergic rhinitis (AR) ever, current symptoms of allergic rhinitis (AR), and diagnosis of AR are 43.9% (42.2 to 45.6), 30.7% (29.1 to 32.4) and 17.1% (14.8 to 18.4) respectively. The prevalence rates (95% CI) for itchy rash ever, current itchy rash, and diagnosis of eczema are 17.5% (16.2 to 18.8), 12.6% (11.4 to 13.8), and 11.3% (10.2 to 12.4) respectively. The prevalence of wheeze ever, wheeze during the last year, and physician diagnosis of asthma are higher in males compared with females, $P < .01$. In multiple logistic regression: male gender (OR 1.6, 95% CI, 1.3 to 2.0) and diagnosis of AR (OR 1.7, 95% CI, 1.4 to 2.2) were associated with the physician diagnosis of asthma even after controlling for symptoms of asthma.

Conclusion: This is the first study on the prevalence of allergic diseases in Kuwait and it shows that children in Kuwait have a moderate prevalence of asthma, AR, and eczema compared with other countries where the ISAAC study is done. The prevalence of asthma is higher in boys compared with girls.

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INTRODUCTION

The prevalence of asthma and allergic diseases vary among nations and countries. This is partly due to a true difference in the prevalence of these diseases and partly due to differences in the definition or the study methodology used to evaluate the epidemiology of these diseases. The international

study of asthma and allergies in childhood (ISAAC) was set up to use standardized written and video questionnaires to study the prevalence of asthma, allergic rhinitis (AR), and eczema in different countries of the world.¹ Kuwait is a small country with a total area of 17,000 km². The population of Kuwait according to 1995 census is 1,575,983 with 655,820 (41%) of them are nationals Kuwaiti while the rest are expatriate. A previous study showed a high prevalence of allergic sensitization to inhalant allergens in Kuwait.² There has not been any study done to examine the prevalence of asthma and allergic diseases in Kuwait. Furthermore, such studies have been few and far in between among the Arab children in general.³

We used the ISAAC methodology to measure the prevalence of asthma, allergic rhinitis and eczema in children aged 13 to 14 and 6 to 7 years in Kuwait. The results of the age group 13 to 14 years will be presented here.

METHODS

Sampling Method

The study was designed to determine the prevalence of asthma among native Kuwaiti children so public schools were chosen to conduct this study where more than 95% of the students are Kuwaiti. Kuwait is divided into five governorates. A list of intermediate level schools from each governorate was generated. Eight schools, four for boys and four for girls, from each governorate were chosen randomly. The third and fourth grades were chosen because they contain the majority of children aged 13 to 14. All children in these years were surveyed. A total of 3,110 Kuwaiti children aged 13 to 14 years representing 9% of all Kuwaiti children in this age group were surveyed.

Questionnaires

The ISAAC written and video questionnaires were used.⁴ The written questionnaire was translated to Arabic by one of the authors (NB). Then the Arabic version was reviewed by professional translator and two other authors (AA,JA). A final Arabic version was agreed upon by consensus. Local expressions were used when it was felt that the students might not understand the equivalent Arabic terms. The video questionnaire consisted of five sequences showing different symptoms of asthma ("Appendix A"). The survey was done for each class at a time. The written questionnaire was administered

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first followed by the video questionnaire. Initially the study was planned to include 3,000 students as recommended by the ISAAC committee but the study was done in two stages: the first stage was carried out in October to November 1995 while the second stage was carried out between October to December 1996. This was not planned from the beginning but the study was interrupted due to lack of manpower. The results from 1,056 students were obtained in the first stage and the results from 2,054 students were obtained in the second stage. Approvals to conduct the survey were obtained from the appropriate authorities in the ministry of health and ministry of education.

Statistical analysis

The data were entered into the computer according to ISAAC committee instructions. Twenty percent of the data entries from each school were checked again by a second person. Errors at data entries were found in <2% of the cases. The data was analyzed using SPSS software. We calculated the prevalence and 95% CI for each of the symptom. We made a comparison between males and females using chi-square test and *P* value <.05 was considered significant. We did a multivar-

iate analysis using multiple logistic regression looking for the most important factors associated with a physician diagnosis of asthma.

RESULTS

There were no significant differences between the results obtained from either the first or the second stages of the study for all the items of the written or the video questionnaires apart from nocturnal cough. The prevalence of nocturnal cough was higher in the second stage 42% compared with the first stage 31%, *P* .001. This difference is surprising but it does not affect the overall results and conclusion of the study. The combined results of the two stages are presented below.

Written questionnaire

Missing data for the key questions, eg, presence of symptom ever or physician diagnosis of any of the conditions ranged from 2% for wheeze ever to 9.5% for physician diagnosis of eczema. As recommended by the ISAAC committee, these missing data were included in the denominators when calculating the prevalence. Responses to the written questionnaire divided according to gender are presented in Table 1. The overall prevalence rates (95% CI) for wheeze ever, wheeze

within the last year, and physician diagnosis of asthma were 25.9% (24.4 to 27.4), 16.1% (14.8 to 17.4), and 16.8% (15.5 to 18.1). Boys had higher prevalence rates than girls for symptoms of asthma as well as physician diagnosis of asthma Table 1. The most significant differences were found in the prevalence rates of exercise induced wheeze, 27.7% for boys versus 17.4% for girls, and physician diagnosis of asthma, 21.5% for boys versus 12.6% for girls, *P* < .001.

The prevalence rates for symptoms of allergic rhinitis (AR), symptoms of AR within the last year, and physician diagnosis of AR were 43.9%, 30.7%, and 17.1% respectively. The boys had higher physician diagnosis of AR (21.3%) compared with the girls (13.2%), *P* < .001. The prevalence rates for itchy rash ever, rash within the last year, and physician diagnosis of eczema were 17.5%, 12.6%, and 11.3% respectively. The boys had higher rate for rash ever 20.7% compared with the girls 14.5%, *P* < .001 and a higher rate for rash within the last year, 15.1% for boys compared with 10.3% for girls, *P* < .001 while physician diagnosis of eczema was not significantly different between boys and girls.

Table 1. Responses to the Key Questions of the Written Questionnaire

	Boys		Girls		Total	
	%	95% CI	%	95% CI	%	95% CI
Sex	48	52				
Wheeze ever*	28.7	26.4–30.9	23.3	21.2–25.4	25.9	24.4–27.4
Wheeze in the last 12 months*	18	17.9–19.7	14.3	12.4–16	16.1	14.8–17.4
Severe wheeze in the last year*	9.8	7.3–10.3	7.1	5.8–8.4	7.3	6.2–7.4
Diagnosis of asthma†	21.5	18.4–23.6	12.6	11–14.2	16.8	15.5–18.1
Exercise-induced wheeze in the last year†	27.7	25.4–30	17.4	15.6–19.2	22.4	20.9–23.9
Nocturnal cough in the last year*	40.6	38.1–43.1	36.3	34–38.6	38.4	36.7–40.1
Symptoms of rhinitis ever	45.1	43.1–47.2	42.7	40.3–45.1	43.9	41.2–45.6
Symptoms of rhinitis in the last year	31.4	29–33.8	30	27.8–32.2	30.7	29.1–32.3
Itchy and red eyes in the last year	17	15.1–18.9	15.6	13.8–17.4	16.2	14.9–17.5
Diagnosis of allergic rhinitis†	21.3	19.2–23.4	13.2	11.5–14.9	17.1	15.8–18.4
Itchy rash ever†	20.7	19.6–22.8	14.5	12.8–16.2	17.5	16.2–18.8
Itchy rash in the last year†	15.1	13.3–16.9	10.3	8.8–11.8	12.6	11.4–13.8
Itchy flexural rash in the last year*	13.0	11.3–14.7	9.2	7.8–10.6	11	9.9–12.1
Diagnosis of eczema	12.3	10.6–14	10.4	9.9–11.9	11.3	10.2–12.4

* *P* < .05 and † *P* < .001 boys compared with girls.

Table 2. Responses to the Video Questionnaire

	Boys		Girls		Total	
	%	95% CI	%	95% CI	%	95% CI
Combined® wheezing ever by video*	38.5	36–41	33.6	31.3–35.9	36	34.3–37.7
Combined wheeze in the last year†	33.7	30.7–36.7	29.4	26.8–32	31.3	29.3–33.3
Wheeze at rest ever	19.3	17.3–21.3	16.7	14.9–18.5	17.9	16.6–19.2
Wheeze at rest in the last year	14.6	12.8–16.4	12.6	11–14.2	13.6	12.4–14.8
Wheeze at rest ≥ 1 per month†	11.5	9.9–13.1	8.3	7–9.6	9.8	8.8–10.8
Wheeze during exercise ever‡	28.3	26–30.6	25.7	23.6–27.8	26.9	25.3–28.5
Wheeze during exercise in the last year	21.7	29.6–23.8	20.2	18.2–22.2	20.9	19.5–22.3
Wheeze during exercise ≥ 1 per month	18.4	16.4–20.4	16.4	14.6–18.2	17.4	16.1–18.7
Nocturnal wheeze ever‡	14.8	13–16.6	10.3	8.8–11.8	12.5	11.3–13.7
Nocturnal wheeze in the last year‡	11.2	9.6–12.8	7.3	6–8.6	9.2	8.2–10.2
Nocturnal wheeze ≥ 1 per month‡	5.2	4.1–6.3	3.3	2.4–4.2	4.2	3.5–4.9
Nocturnal cough ever§	19.9	17.9–21.9	22.6	20.6–24.6	21.3	19.9–22.7
Nocturnal cough in the last year§	14.6	12.8–16.4	17.8	15.9–19.7	16.2	14.9–17.5
Nocturnal cough ≥ 1 per month§	12	10.4–13.6	14.9	13.2–16.6	13.5	12.3–14.7
Severe asthma attack ever†	13.3	10.6–15	11.2	9.7–12.7	12.2	11–14.4
Severe asthma attack in the last year†	10.8	9.2–12.4	7.8	6.5–9.1	9.2	8.2–10.2
Severe asthma attack ≥ 1 per month†	8.8	7.4–10.2	6.3	5.1–7.5	7.5	6.6–8.4

* Combined defined as a positive response to any the first three wheeze sequences in the video questionnaire (wheeze at rest, wheeze during exercise, or nocturnal wheeze).

† $P < .05$ with boys have higher value than girls.

‡ $P < .001$ with boys have higher value than girls.

§ $P < .05$ with girls having higher value than boys.

Concordance Between Video and Written Questionnaires

The responses to the video questionnaire are shown in Table 2. Similar to the written questionnaire, the boys had higher prevalence rates for wheeze ever and wheeze in the last year but unlike the written questionnaire, in the video questionnaire nocturnal cough was reported more commonly by the girls compared with the boys (Table 2). When the response to the written

questionnaire is compared with the response to the first video sequence (wheezing at rest), the concordance rates between the two questionnaires were strong 79% for wheeze ever and, 81% for wheeze within the last year (Table 3). When wheezing ever in the video is defined as a positive answer to any of the first three video sequences (wheezing at rest, wheezing during exercise, or nocturnal wheeze), then the concordance between written and

video questionnaires decreases (Table 4). The proportion of agreement for negative responses was good, however the proportion of agreement for positive responses was poor (Tables 3 and 4).

Factors Associated with Physician Diagnosis of Asthma

To determine the factors associated with physician diagnosis of asthma, a multiple stepwise logistic regression was done (Table 5). As expected exer-

Table 3. The Prevalence of Wheeze Ever, Wheeze Within the Last Year and Severe Wheeze: Concordance Between the ISAAC Written and Video Questionnaires

Questionnaire		Wheeze Ever		Wheeze in the Last Year		Severe Asthma Attack in the Last Year	
Written	Video*	n	%	n	%	n	%
no	no	2108	68	2385	77	2661	86
yes	yes	362	12	198	6	100	3.2
yes	no	444	14	303	10	161	5.1
no	yes	196	6	148	7	187	6
Concordance		2470	79	2522	81	2761	89
Proportion of agreement		P		P		P	
Negative responses		.77		.82		.88	
Positive responses		.36		.27		.22	

* The response to the first video scene (wheeze at rest) is considered only, **P** stands for proportion of agreement.

Table 4. The Prevalence of Wheeze Ever, Current Wheeze: Concordance Between the ISAAC Written and Video Questionnaires

Questionnaire		Wheeze Ever		Wheeze in the Last Year	
Written	Video*	n	%	n	%
no	no	1732	56	2055	66
yes	yes	547	17.5	311	10
yes	no	259	8	190	6
no	yes	572	18	554	18
Concordance		2279	73	2366	76
Proportion of agreement		P		P	
Negative responses		.67		.73	
Positive responses		.40		.29	

* Wheeze in the video questionnaire is defined a positive response to any of the first three video sequences (wheeze at rest, wheeze during exercise or nocturnal wheeze), **P** stands for proportion of agreement.

cise induced wheeze, nocturnal cough, and wheeze in the last year were associated with physician's diagnosis of asthma but surprisingly male gender was an independent risk factor for the diagnosis of asthma OR 1.6 (95% CI 1.3 to 2.0). This remained significant even after accounting for current

wheeze, nocturnal cough, and exercise induced wheeze.

DISCUSSION

Using ISAAC questionnaires, we were able to show that there is a high prevalence of asthma among 13 to 14-year-old children in Kuwait. This enabled us to compare our prevalence rates to other countries and monitor the future trends in asthma prevalence.

Phase I of ISAAC uses both written and video questionnaires to assess the prevalence of asthma and allergic diseases in different countries. The combined results of phase I study in 56 countries has been published recently.^{5,6} The figures from Kuwait in the ISAAC reports were based on the initial survey of 1,056 students while this report include the results of the first and second surveys. Kuwait ranks number 13 in the prevalence of current asthma symptoms among the 56 countries where the study was done. The prevalence is higher than other countries in the Arab world where similar surveys were done namely Oman, Morocco, and Lebanon. A study done in Saudi Arabia which is a neighboring country to Kuwait showed that the prevalence of wheeze ranged from 6% to 11.8%, rhinitis 12% to 17% in different regions the country.³ This is lower compared with the prevalence in Kuwait, which is a 16.1% for wheeze within the last year and 30.7% for symptoms of rhinitis within the last

year. Unfortunately there are no previous population-based epidemiologic studies on asthma or allergic diseases in Kuwait to enable us to examine the trend of asthma prevalence. But Stranegard and colleagues⁷ found that the percentage of childhood asthma admissions of all emergency admissions to one general hospital in Kuwait had increased from 8.8% in 1982 to 14.9% in 1985. Furthermore the problem of allergic rhinitis in Kuwait has been recognized as early as 1964.⁸ Subsequent studies found a very high prevalence of allergic sensitization to air born allergens among asthmatics in Kuwait.^{9,10} Among 1,000 consecutive asthma patients evaluated at Kuwait allergy center, 756 (76%) had evidence of atopy.¹⁰ Eighty percent of the atopic asthma patients were sensitized to pollens from local trees and plants namely *Prosopis* (Mesquite) tree, *Chenopodium album* (salt Bush), and Bermuda grass. A more recent study found a high level of sensitization (44%) to common airborne allergens among healthy blood donors in Kuwait.² It is interesting to note that in this study, nationals of Kuwait had a higher prevalence of sensitization (50%) compared with non-nationals (34%). It is generally believed that this high prevalence of sensitization is mainly due to the plantation and cultivation process of foreign trees to the urban areas of Kuwait.^{8,10,11}

Table 5. Factors Associated with Physician Diagnosis of Asthma by Multivariate Logistic Regression

	OR	95% CI
Sex*		
Female	1	—
Male	1.6	1.3–2.0
Rhinitis symptoms in the last year		
No	1	—
Yes	1	0.8–1.3
Diagnosis of rhinitis*		
No	1	—
Yes	1.7	1.4–2.2
Itchy rash in the last year		
No	1	—
Yes	1	0.8–1.4
Diagnosis of eczema		
No	1	—
Yes	1.1	0.9–1.3
Exercise induced wheeze*		
No	1	—
Yes	2.1	1.6–2.6
Nocturnal cough*		
No	1	—
Yes	2.1	1.6–2.6
Wheeze in the last year*		
No	1	—
Yes	3.5	2.7–4.4

* $P < .05$.

We found that physician diagnosis of asthma was higher in boys (21.1%) compared with girls (12.6%), $P = .001$. This seems to reflect a true gender difference in the prevalence of asthma in this age group because the prevalence rates of symptoms of asthma were higher in boys compared with girls. Some of these symptoms like exercise-induced wheeze may be explained by the difference in lifestyle as boys tend to exercise more than girls in Kuwait. But similar results were found in studies done in other countries like UK, Hong Kong, and New Zealand where there is not a large difference in lifestyle between boys and girls as far as the amount of exercise done.¹²⁻¹⁴ In the multivariate analysis, the male gender was independently associated with the diagnosis of asthma even after accounting for the differences in prevalence rates of symptoms of asthma. This suggests that physicians in Kuwait may underdiagnose asthma in girls. A study where there is objective assessment is needed to find out the true magnitude of gender difference in the prevalence of asthma in Kuwait.

The video questionnaire used in this study is specifically developed for international comparison and both the written and video questionnaires have been tested and validated against bronchial hyperresponsiveness in both English speaking and Chinese speaking communities.^{15,16} The ISAAC protocol recommends combining the responses to the first three video sequences (wheeze at rest, wheeze during exercise and nocturnal wheeze) when comparing the prevalence of wheeze ever and wheeze within the last 12 months between the written and video questionnaire. We found that combining the responses to the first three video sequences result in a significant drop in concordance compared with the result obtained when the response to the first video sequence is taken only. The prevalence of wheeze ever was higher in the video questionnaire (38%) compared with the written questionnaire (25.6%), which is similar to the finding of Pearce and colleagues.¹⁷ Further-

more, we found that despite having a good overall concordance, the proportion of agreement for positive responses is poor which is similar to the finding of other studies.^{17,18} For wheeze within the last 12 months, 501 students answered "yes" to the written questionnaire while 190 of them (38%) answered no to all three video sequences of wheeze (Table 4). Similarly 744 students answered "yes" to at least one of the three video sequences and 554 of them (74%) answered no to the written questionnaire Table 4. We believe that despite the fact that the video questionnaire has been validated against bronchial hyperresponsiveness, our study and others^{12,17,18} show that there is a poor agreement between the written and video questionnaires for positive responses which make the interpretation of prevalence rates between the two questionnaires rather difficult and question the additional value of the video questionnaire for international comparison. This can only be solved by having more objective assessment of asthma, which is planned for phase II of ISSAC.

Since the study was done in two stages 1995 and 1996, we compared the pollen levels between 1995 and 1996. The median daily pollen level was 14.5 (0 to 317) pollen grains/m³ for 1995 and 12 (0 to 341) pollen grains/m³ for 1996, $P = .5$.¹⁹ A part from nocturnal cough there were no significant differences between the two stages in any of the prevalence rates of the other symptoms. This difference in nocturnal cough between the two stages can not be explained by the pollen count.

In conclusion, we found that there is a high prevalence rates for asthma and allergic diseases among school children in Kuwait compared with other countries. The prevalence of asthma is higher among boys compared with girls, which is similar to the finding in other countries. There is a need for further studies with objective assessment of the prevalence of asthma and the risk factors associated with the development of asthma among children in Kuwait.

APPENDIX A

The video questionnaire consisted of 5 sequences and each sequence is followed by three questions. The five sequences are:

1. A young person wheezing (while at rest)
2. Wheezing after exercise
3. Waking at night with wheezing
4. Waking at night with coughing
5. A severe attack of asthma, involving difficulty breathing at rest

Questionnaire

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1. Has your breathing ever been like this:

At any time in your life?	Yes	No
If yes,; in the last year?	Yes	No
If yes,; one or more times a month?	Yes	No
 2. Has your breathing been like the girls's in the video following exercise?

At any time in your life?	Yes	No
If yes,; in the last year?	Yes	No
If yes,; one or more times a month?	Yes	No
 3. Have you been awaken like this at night:

At any time in your life?	Yes	No
If yes,; in the last year?	Yes	No
If yes,; one or more times a month?	Yes	No
 4. Have you been awaken like this at night:

At any time in your life?	Yes	No
If yes,; in the last year?	Yes	No
If yes,; one or more times a month?	Yes	No
 5. Has your breathing been like this:

At any time in your life?	Yes	No
If yes,; in the last year?	Yes	No
If yes,; one or more times a month?	Yes	No
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