

Original article

Allergic rhinitis: prevalence and possible risk factors in a Gulf Arab population

Background: Epidemiological studies mainly from Europe, the USA and Asia indicate a high prevalence of allergic rhinitis (AR) in modern societies. However, little is known about AR among the heterogeneous population of the United Arab Emirates (UAE). Objectives: To estimate the prevalence of AR and its independent risk factors in Al-Ain City, UAE.

Methods: We used a validated, self-administered questionnaire modified from the ISAAC study to collect data from a two stage randomly selected sample of 10 000 school children. Overall, 7550 subjects (aged 13 years and above, siblings, and their parents) responded. We assessed the prevalence of AR (both crude and standardized prevalence of previous 12 months) as well as the independent relationship of AR with age, gender, education, nationality and family history by means of logistic regression.

Results: The response rate was 76%. A total of 6543 subjects (median age 30 years) were included in the final analysis. Self-reported prevalence of AR (having symptoms in the past 12 months) was 36%, while adjusted values for sex/age yielded a prevalence of 32%. Regression analysis revealed that AR was independently associated with family history, Arab origin, younger age, female gender and higher education.

Conclusions: The relatively high prevalence of AR found in this study may be attributable to modernization and genetic factors. Further studies on the impact of rapid environmental and cultural changes on AR in the Arab countries are needed and currently planned in conjunction with GA²LEN (Global Allergy and Asthma European Network).

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Key words: allergic rhinitis; epidemiology; prevalence; risk factors; United Arab Emirates.

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Accepted for publication 11 May 2009

Allergic rhinitis (AR) is a common atopic disorder in all age groups, and in different ethnic groups throughout the world (1, 2). It is characterized by at least one of the following symptoms: sneezing, itching, nasal obstruction (blockage) and mucous discharge (3). AR, often triggered by exposure to allergens (4), has serious adverse effects not only on the quality of life and work productivity, but also learning abilities and medical expenditure (5–8).

The prevalence of AR seems to have increased over the past decades often being reported in more than 50% of the adult population (9). In addition, profound variations were reported in the prevalence of atopic diseases among different ethnic groups (10, 11). Other studies concluded that the differences in allergic sensitization between African-Americans and Caucasians-Americans, for example, may be mainly due to environmental factors rather than genetic inheritance (12). Given the importance of these variations, significant efforts to develop global programmes for research on prevention, diagnosis and treatment are being made internationally (13).

Of particular concern is the limited available information with regard to the prevalence and the independent risk factors for AR among children and adults in countries undergoing rapid development transition such as the UAE. From the available evidences vis-à-vis the relatively high prevalence of other allergic diseases such as asthma (14), possibility is high that AR may also be of considerable magnitude. Existing risk factors for AR may include, among other things, nonspecific triggers i.e. air pollutants often implicated as contributing factors in AR's morbidity (15). To assess the prevalence of AR and to determine common risk factors, we conducted this epidemiological study among adolescents and adults in Al-Ain, a significantly populated city in the UAE.

Material and methods

The Ethics Review Committee of the Faculty of Medicine and Health Sciences, UAE University, approved the study protocols and

all subjects (children, siblings, and their parents) gave an informed consent.

Subjects and data collection

We carried out an epidemiological survey using a modified questionnaire for allergies in line with the protocols of the International Study of Asthma (ISAAC) (16). Two stage randomly selected sample of adolescents aged 15 years and older, and their parents, the overwhelming majority of which were UAE nationals, were included. Demographic data, clinical history of rhinitis (nasal blockage, rhinorrhoea, sneezing and irritation) were recorded. Detailed protocols of this study have been published elsewhere (17). In short, a modified questionnaire from the ISAAC study validated in a pilot phase has been used.

Definition of allergic rhinitis

The definition of AR used in this study was: having had AR symptoms of (nasal blockage, rhinorrhoea, sneezing and irritation), in the past 12 months.

Statistical analysis

We assessed the prevalence of AR and computed an age/sex adjusted prevalence (direct standardization) with the total UAE population as the reference population (Census 2005) if the age/sex distribution of the study population differed markedly from that of the total UAE population. In (according to our definition) AR patients, we assessed the prevalence of symptoms: in the past 12 months: sneezing, itching, nasal obstruction (blockage) and mucous discharge. We used multivariate logistic regression to assess the crude association of AR with age (age groups 13–19 and > 19 years), gender, education, nationality and parental asthma (or family history of asthma, as applicable). We assessed the independent relationship of AR with these risk factors by means of logistic regression (the model was assessed stepwise with the Backward Wald method). The final model was tested with the multilevel structure (levels: school, family and family members) of the data taken into account. Subjects with missing values were excluded from the multivariate model. A *P*-value of 0.05 or less was considered significant. SPSS (version 15) was used for all analyses except for multilevel logistic regression which we did with STATA (version 10.0).

Results

A total of 7550 subjects were responded to our invitation to participate (response rate 75.5%). However, only 6543 samples were included in the final analysis due to inconsistently reported age (such as mothers of index subjects reporting an age of 12 years) in about 13% of the subjects. The median age was 30 years (range 8–93 years), 53% were males. The characteristics of the study population are shown in Table 1.

Overall, AR was reported by 2352 out of 6543 participants [36%, 95% confidence interval (95% CI): 35–37%]. The age/sex distribution of the study population was different from that of the UAE population because the adolescent group was overrepresented. The standardized (direct) prevalence was 32% (95% CI:

Table 1. Characteristics of the study participants (*n* = 6543)

Variable	<i>n</i> (%)
Age (years)*	
<13	8 (0)
13–19	2802 (43)
>19	3733 (57)
Gender	
Male	3434 (52)
Female	3109 (48)
Nationality	
UAE	3158 (48)
Other Arabs	2490 (38)
Others	863 (13)
Missing†	32 (1)
Education	
Illiterate/Primary school	881 (14)
Elementary school	1258 (19)
Secondary school	2865 (44)
University/Post graduate	1381 (21)
Missing†	158 (2)
Family history	
No	3236 (50)
Yes	1914 (29)
Missing†	1393 (21)

*Median age was 30 years (range 8–93 years).

†Some subjects did not answer this question.

Table 2. Frequency, timing and intensity of symptoms in subjects reporting allergic rhinitis* (*n* = 2352)

Variable	<i>n</i> (%)
Interfering with daily activities	1694 (72)
Perennial symptoms	81 (3)
Symptoms reported ≥3 months/year	791 (34)
Symptoms reported in spring (March/April/May)	615 (26)
Symptoms reported in autumn (September/October)	59 (3)

*In the past 12 months.

Seasonal AR around the spring time as there is pollination newly planted trees.

30–34%). In the age group 13–19 years the self-reported prevalence was 41%, whereas the prevalence was 32% among the group over 19 years of age. The distribution of severity and timing of symptoms is shown in table 2.

All independent variables considered (nationality, age, gender, family history of AR and education) showed a significant association with AR in univariable logistic regression. They were, therefore, all included in the multivariable analysis. Results of this analysis [crude and adjusted odds ratios (OR) with 95% CI] are shown in Table 3: a family history of AR significantly increased the risk of having AR [OR_{adj} = 6.08, 95% CI = (4.93–7.50)], 'other' nationality (other than Arabs) significantly decreased the risk of AR [OR_{adj} = 0.48, 95% CI = (0.34–0.68)], subjects older than 19 years had significantly lower risk of AR compared to those 19 years or younger [OR_{adj} = 0.66, 95% CI = (0.54–0.81)], males had significantly lower risk than females [OR_{adj} = 0.75, 95%

Table 3. The independent risk factors for AR ($n = 6346^*$)

	AR (%)	OR (Crude)	OR (Adjusted†)	95% CI (Adjusted†)	P-value (Adjusted†)
Nationality					
(ref) UAE	38.4	—	—	—	—
Other Arabs	38.6	1.01	1.08	0.87–1.35	0.48
Other	19.7	0.39	0.48	0.34–0.68	<0.0005
Age					
(ref) 13–19	40.7	—	—	—	—
>19	32.3	0.70	0.66	0.54–0.81	<0.0005
Gender					
(ref) Female	39.2	—	—	—	—
Male	33.0	0.76	0.75	0.63–0.88	0.001
Family history of AR					
(ref) No	23.2	—	—	—	—
Yes	56.7	4.34	6.08	4.93–7.50	<0.0005
Education					
(ref) Illiterate/Primary	30.3	—	—	—	—
Elementary	39.8	1.52	1.34	0.72–1.87	0.08
Secondary	36.8	1.34	1.23	0.91–1.65	0.17
University	35.0	1.24	1.42	1.05–1.93	0.02

Crude and adjusted odds ratios (OR) with 95% confidence intervals (95% CI). AR was reported by 2352 out of 6543 participants (36%, 95% CI: 35%–37%).

*Due to missing values, not all 6543 subjects were included in this model.

†The multivariate model included all variables selected by the backward (Wald) method. These OR are results of multilevel logistic regression and are adjusted for all other variables in the table.

CI = (0.63–0.88) and compared to subjects with no or only primary education, all other groups were at higher risk, with only the group with university education having a significant adjusted OR [1.42, 95% CI = (1.05–1.93)].

The adjusted results presented here are from multilevel analysis. The models not taking account of the multilevel structure yielded similar results (not shown), except that the association with family history of AR was less strong, but still highly significant.

Discussion

The current study reports a crude overall prevalence of AR of 36%, and a standardized prevalence of 32% in a relatively large sample from a heterogeneous population. In the age group 13–19 years the self reported prevalence was 41%, whereas the prevalence was 32% among the group over 19 years of age mostly during the spring. Multivariable analysis showed that family history, Arab nationality, younger age, female gender and higher education, were all significantly and independently associated with the prevalence of AR.

The discovery of oil in the UAE has lead to impressive development programmes with positive impact on living conditions, health care and education (18). Among other things massive plantation programmes were implemented with appreciable changes in the country's environmental landscape. In particular the city of Al-Ain, with its

approximately 500 000 inhabitants, is an inland desert oasis and has the highest number of date palm trees, public gardens, plantations and grass covered areas in the country. Moreover, the ever increasing wealth in the UAE has helped frequent imports of food items from all over the world, which were never seen in this part of the world until a few decades ago, and are now not only plenty available, but also affordable by the majority of the population. Such massive environmental changes, though appreciable, may have (had) a huge adverse impact on the prevalence of allergic diseases. Despite the significant environmental changes, however, Al-Ain and its surroundings are known to be less polluted as opposed to other major cities in the country particular that it has far less vehicles on the road, less industrialized, and to certain extent, less humidity thus better climate. In contrast therefore, we expect that the prevalence of AR and its consequences may possibly be much higher in other major cities. In other words, it would be difficult to generalize these results in the wider context of the country populations.

In 1994, the prevalence of AR was reported as approximately 23% among children aged 6–14 years in the UAE (19). The study shows a much higher prevalence, not only among 13–19 year old children (41%), but also among the adult population (32%) in the UAE. These results seem to indicate an increased prevalence over time, but, since the age of the study populations are different, it is not possible to disentangle age and cohort effects. Our high prevalence may possibly be explained by selection bias: if subjects with AR were more likely to respond, our current finding might be an over estimation of the actual prevalence. However, similar, or lower, response rates (our response rate was 75%) are common in this type of studies. Increased pollen exposure may be another explanation for the high prevalence of AR. Such hypothesis is further supported by the fact that most, if not all, of the plantations are imported from overseas as opposed to trees found in the natural habitat of the desert. If proven true, this hypothesis may indicate an increased trend of AR, however, we could not rule out the possibility of plateau prevalence, a phenomena that has been observed elsewhere in the world. Clearly, the current data does not provide appreciable evidence to elucidate the above possibilities.

Our definition of AR was based on self-reported symptoms in the past 12 months. This approach may have resulted in an overestimation of the prevalence as opposed to physician diagnosed AR. However, the current results are comparable with data from other Arabian Gulf countries where similarly high prevalence figures were reported (20, 21) and findings from the Western hemisphere (22).

Our data show some significant and independent variables which are associated with AR in both age groups. Of these, family history (father and mother) of rhinitis showed the strongest association. This finding is

particularly interesting as other investigators have previously reported similar relationships with family history in this population (23). The implications of these consistent findings may not be very much clear from the current study, but are indicative of a probable genetic influence on the development of allergies in this Arab population. The association between AR and nationality (UAE national and other Arabs having higher risk), does indeed lend weight to the aforementioned hypothesis.

Perhaps, the higher prevalence in younger age groups can be explained by a greater exposure to outdoor allergens among children as compared to adults, as children visit public gardens more frequently; but it may also be explained by cohort effects. With regard to females, we think that the higher prevalence is in line with the (unexplained) higher risk of asthma that is in general found in adult females. Together, the current findings support the hypothesis that AR may be triggered by both environmental and genetic factors in this Arab population.

The self-reported nature of the data collected in this study may have limited the estimated prevalence of AR. Further, we had no recollection of pollen counts in the UAE at the time of this study. However, a major strength is that our study adds information to the results of international methods such as the ISAAC and additional studies are currently planned in conjunction with GA²LEN (Global Allergy and Asthma European Network).

Although our response rate was relatively high, selection bias might possibly have resulted in an overestimation of

the prevalence of AR. However, it is undisputable that AR has become a frequent disease in the UAE and this leads to new challenges in Healthcare. To ensure standardized and optimized treatment physicians need to be trained to implement the updated guideline ARIA (24–27). This is important not only to avoid disease progression and morbidity but also to reduce an avoidable socio-economic burden of the disease due to productivity losses in untreated disease.

In conclusion, the prevalence of AR in the UAE is higher than previously reported in both children and adults and may be comparable to findings in other Arabian Gulf countries. Possible explanations may include vigorous environmental changes in the past decades and probably genetic influence. This study confirms other findings of increasing prevalence of allergic diseases in modernizing societies.

Acknowledgments

The authors wish to acknowledge generous financial support from the Faculty of Medicine and Health Sciences, UAE University.

Conflict of interest

None of the authors has any conflict of interest

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