Asthma prevalence among adults in Saudi Arabia

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ABSTRACT

الأهداف: دراسة انتشار الربو وأعراضة لدى البالغين السعوديين في الرياض ، المملكة العربية السعودية.

الطريقة: أجريت دراسة مستعرضة باستخدام استبيان المسح الصحي التنفسي للمجتمع الأوروبي من شهر أبريل إلى شهر يونيو 2016م بين الذكور والإناث السعوديين الذين تتراوح أعمارهم بين 44–20 عاما في الرياض. حيث اُستخدمت الطريقة العنقودية لأخذ العينات. وقد عرف الربو بناء على التالي: هل تسمع صوت صفير عند عدم تعرضك للبرد في 12 الأشهر الماضية ؟ هل أخبرك طبيب من قبل أنك تعاني من الربو؟ هل تتناول أدوية للربو؟

النتائج: أكمل الإحصائية 2،405 مشارك. حيث أن نسبة انتشار الصفير بين الذكور والإناث في 12 شهر الماضية بدون التعرض للبرد 18.2% مع عدم وجود فرق بينهم (p=0.107). بينما كانت نسبة تشخيص الأطباء لانتشار الربو بين الذكور والإناث 11.3% مع عدم وجود فرق بينهم (p=0.239). وبلغ معدل استخدام أدوية الربو 10.6%. ولم يظهر هنالك فروق ذات دلالة إحصائية من حيث مكان الإقامة (p=0.07)، والمستوى التعليمي (p=0.11)، وتدخين التبغ (p=0.06) بين الأشخاص المصابين وغير المصابين بالربو. ولكن ظهرت اختلافات ذات دلالة إحصائية بين المصابين وغير المصابين بالربو وحساسية الأنف (p>0.001).

الخاتمة: معدل انتشار الربو مرتفع حيث أنه أعلى بكثير من المبلغ عنه في معظم الدول التي استخدمت نفس الاستبيان .

Objectives: To investigate asthma prevalence and to measure asthma symptoms among Saudi adults in Riyadh, Kingdom of Saudi Arabia.

Methods: A cross-sectional survey using the European Community Respiratory Health Survey (ECRHS) questionnaire carried out between April and June 2016, among male and female Saudi nationals aged 20-44 years living in Riyadh. Disproportionate cluster sampling method was used. Asthma was defined based on answering "yes" to any of the following: Have you had wheezing when you did not have a cold in the last 12 months? Have you been told by a physician to have asthma? Are you taking medicine for asthma?

Results: A total of 2,405 participants completed the survey. The prevalence of wheezing in the last 12 months when not having a cold was 18.2% with no significant difference between males and females (p=0.107). The prevalence of physician-diagnosed asthma was 11.3% with no significant difference between males and females (p=0.239). The prevalence of taking medicine for asthma was 10.6%. There were no significant differences between asthmatic vs. non-asthmatic in terms of residency area (p=0.07), education level (p=0.11) and smoking tobacco (p=0.06). However, significant differences found between asthmatic and non-asthmatic in relation to nasal allergies (p<0.001).

Conclusion: Asthma prevalence is high and much higher than the prevalence reported in most countries using the ECRHS questionnaire.

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Asthma is a chronic inflammatory airway disease, affecting millions of people globally. The prevalence of asthma is variable around the world, ranging from 1-20% for both children and adults.[1] These wide variations are related to environmental variations among countries, in addition to the use of different measurement tools and different epidemiological definitions of asthma. In Saudi Arabia, the prevalence of asthma in children

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and adolescents has been investigated. Al-Ghamdi et al[2] reported the prevalence of bronchial asthma in the southern region of Saudi Arabia, at sea level, as 19.5% and 6.9% at a higher altitude. Al Ghobian MO et al[3] reported a prevalence rate for a lifetime wheeze of 25.3%, 18.5% for a wheeze during the past 12 months and 19.6% for physician-diagnosed asthma among male and female students aged 16-18 years in Riyadh.[3] According to the Saudi Initiative for Asthma (SINA 2016), the overall prevalence of asthma in children ranges from 8-25% based on studies conducted over the past 3 decades.[4] Saudi Initiative for Asthma panels believed that this increment is multifactorial, part of it could be related to rapid modernization of our community, or it could be attributed to environmental factors (mainly sandstorms).[4] Results from a national Saudi household survey in 2013, estimating the burden of chronic medical conditions including asthma among the Saudi population aged 15 years or older, indicated a self-reported clinical diagnosis of asthma to be 4.05%.[5] The prevalence of asthma in Saudi adults is under-investigated. Saudi Initiative for Asthma did not report the prevalence of asthma in adults, stating that there is a need to investigate asthma among the adult Saudi population. The European Community Respiratory Health Survey (ECRHS) used to address asthma epidemiology in adults,[6] while the International Study on Asthma and Allergy in Children (ISAAC) was designed for asthma in children and adolescents.[7] Phase I of the European Community Respiratory Health Survey consisted of 140,000 adults recruited from 25 countries providing key information regarding adult asthma such as the geographical variation in prevalence and risk factors.[8] The Phase II survey was conducted as a nine-year follow-up prospective survey. Currently, Phase III is in progress to investigate adult-specific risk factors or temporal changes in the prevalence of adult asthma. The ECRHS questionnaire has been accepted as the standard epidemiological tool allowing the comparison of the prevalence of asthma and asthma-like symptoms in adults in different countries. The ECRHS screening questionnaire consists of 10 uncomplicated but specific questions regarding asthma, enabling large-scale surveys with a target population aged 20-44 years.[9] The objectives of the current study were to investigate the prevalence of asthma using the ECRHS questionnaire and to measure the prevalence of specific asthma symptoms among the Saudi adult population aged from 20-44 years old in Riyadh, Saudi Arabia.

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Methods. The current study is a population-based cross-sectional survey using the ECRHS questionnaire. Inclusion criteria: male and female Saudi nationals aged 20 to 44 years living in Riyadh, Kingdom of Saudi Arabia. Exclusion criteria: subjects who refused or subjects outside the inclusion criteria.

The study was conducted between April and June 2016. Riyadh is the capital and the largest city in Saudi Arabia and has an adult Saudi population age 20-44 years of approximately 2 million. In this study, Riyadh was divided into 4 geographical areas: North, East, West and South. The population size is known to vary per area. To maximize the representativeness of the sample, a disproportionate cluster sampling method was used to select the number of participants needed in each geographical area.

The sample size calculated based on target population of 2 million, and estimated asthma prevalence of 10% with 95% confidence interval. This study used a cluster-based sample, and the sample size was powered by a design effect of 2 to allow for cluster sampling (n=1728). The sample size was further increased to account for a 20% non-response rate. The final sample size was 2,074 participants selected according to the following pre-determined sampling quotas: gender (52.4% male and 47.6% female), geographical area (North 32%, East 39.3%, West 19.4% and South 8.8%). We recruited participants conveniently for an interview from houses, shopping malls and streets. These samples were convenient, though randomly selected, because they are within the age, gender and geographical area domains of the study population. The medical students carried out the interview and they were trained about the objectives of the study and skills of the interview. It was a face-to-face interview with the participants using The ECRHS questionnaire.

The English version of the ECRHS questionnaire was translated into Arabic and validated by authors (translated to Arabic then back translation to English). It was then pilot tested to ensure its clarity. Participants were interviewed using a side-by-side Arabic version. Participants were considered to have asthma symptoms if they answered "yes" to any of the following questions: Have you had wheezing or whistling when you did not have a cold any time in the last 12 months? Have you ever been told by a physician that you have asthma? Are you currently taking any medicine (including inhalers,

aerosols or tablets) for asthma? We received approval from the Research and Ethics Committee of King Abdullah International Medical Research Center and the written informed consent was obtained from the participants after explaining the purpose of the study as well as anonymity and confidentiality.

We used Statistical Package for Social Sciences version 18 (SPSS Inc, Chicago, IL, USA) for data analysis. Descriptive statistics were used to summarize the variables. We calculated odds ratios (OR) with 95% confidence interval (CI) for the correlation between the prevalence and the predictors. Pearson's Chi-squared test was used to determine associations between categorical variables. A p-value<0.05 was considered significant.

Results. A total of 2,500 Saudi nationals were recruited, with a final sample size of 2,405 participants completing the ECRHS questionnaire (response rate: 96.2%). The proportion of males was 52.4% compared to 47.6% females. Age ranged from 20 to 44 years old. Most of the participants (72%) had a tertiary education. The baseline characteristics of the study population are shown in **Table 1**.

The prevalence of wheezing or whistling in the chest at any time in the last 12 months when the participant did not have a cold was 18.2% with no significant difference between males and females (p=0.107). The prevalence of physician-diagnosed asthma was 11.3% with no significant difference between males and females (p-value=0.239) and currently taking any medicine (including inhalers, aerosols or tablets) for asthma 10.6%. In terms of nasal allergies, the prevalence was 33.3% and for smoking any tobacco product 25.0%. The prevalence of asthma related symptoms was as follows: waking up with a feeling of tightness (33%), shortness of breath (31%), attack of coughing (43%) and having had an asthma attack in the last 12 months (5.6%).

There were significant differences between males and females regarding asthma symptoms, female participants were more likely to suffer from chest tightness (p-value<0.001), shortness of the breath (p-value<0.001) and cough (p-value<0.001). The prevalence of smoking any tobacco product was much lower in females than in males (5.8% vs. 42.4%, p-value<0.001)(**Table 2**).

There were no significant differences between asthmatic vs non-asthmatic participants in terms of geographical area in Riyadh (p-value=0.07), level of education (p-value=0.11) and smoking tobacco products (p-value=0.06). However, there was a significant difference between asthmatics compared to non-asthmatic participants in relation to nasal allergies.

Table 1 - Baseline characteristics of the study population (total 2,405 participants).

Characteristics	Male	Female	Total
		n (%)	
Range (age)	20-44	20-44	20-44
Mean (age)	29	26	27.7
Gender	1261 (52.4)	1144 (47.6)	2405
Education level			
Uneducated	10 (0.8)	9 (0.7)	19 (0.8)
Secondary and below	356 (28.2)	298 (26.0)	654 (27.2)
Tertiary	895 (71.0)	837 (73.2)	1732 (72.0)
Residency			
North	424 (33.6)	359 (31.4)	783 (32.6)
South	95 (7.5)	116 (10.1)	211 (8.8)
East	507 (40.2)	438 (38.3)	945 (39.3)
West	235 (18.6)	231 (20.2)	466 (19.4)

Table 2 - The prevalence of asthma and related variables among the participants.

Statements	Male	Female	All	p-value
		n (%)		
Wheezing or whistling at any time in last 12 months	291 (23.0)	232 (20.2)	523 (21.7)	0.210
Wheezing or whistling without cold	247 (19.5)	191 (16.6)	438 (18.2)	0.107
Woken up with chest tightness	346 (27.5)	456 (39.9)	802 (33.0)	0.001
Woken up by shortness of breath	337 (26.7)	420 (36.7)	757 (31.0)	0.001
Woken up by an attack of coughing	506 (40.1)	547 (47.8)	1053 (43.0)	0.001
Physicians-diagnosed asthma	141 (11.1)	131 (11.4)	272 (11.3)	0.239
Asthma attack in the last 12 months	66 (5.2)	71 (6.2)	137 (5.6)	0.122
Currently taking any medicine for asthma	134 (10.6)	122 (10.6)	256 (10.6)	0.117
Nasal allergies	435 (34.5)	366 (32.0)	801 (33.3)	0.194
Smoke any tobacco products	535 (42.4)	66 (5.8)	601 (25.0)	0.001

Table 3 - Logistic regression of variables among asthmatic subjects.

Variables	Overall n=2405		Physician diagnosed asthma n=272			
	n	(%)	n	(%)	*P*-value	OR (95% CI)
Residency					0.079	
North	783	(32.6)	86	(31.6)		1.01 (0.81-1.24)
Other areas	1622	(67.4)	186	(68.4)		
Education						
Secondary and below	667	(27.8)	70	(25.5)	0.112	0.37 (0.14-0.97)
Tertiary	1729	(72.2)	202	(74.5)		
Nasal allergies						
No	1604	(66.7)	130	(47.8)	<0.001	3.23 (2.69-3.88)
Yes	801	(33.3)	142	(52.2)		
Smoke tobacco						
No	1804	(75.0)	202	(74.2)	0.064	1.17 (0.96-1.43)
Yes	601	(25.0)	70	(25.7)		

Asthmatics were more likely to suffer from nasal allergies than non-asthmatic subjects (p-value<0.001) (**Table 3**).

Discussion. This study has addressed the prevalence of asthma and related symptoms in Saudi adults, aged 20 to 44 years living in Riyadh as well as investigating the relationship between asthma and nasal allergies and smoking tobacco products. The study revealed a high prevalence rate of asthma in Saudi adults. The prevalence of wheezing at any time in the last 12 months when not having a cold was 18.2%, the prevalence of physicians-diagnosed asthma was 11.3% and the prevalence of currently taking any medicine for asthma was 10.6%. Moreover, the prevalence of nasal allergies was 33.3% and smoking any tobacco product was 25.0%. There were no significant differences between asthmatic vs. non-asthmatic participants in terms of geographical area of living in Riyadh, level of education and smoking tobacco products.

This study has interesting and unique features as it is the first study to use the ECRHS questionnaire to investigate the prevalence of asthma among adults aged 20-44 years in Saudi Arabia. All previous asthma prevalence studies in Saudi Arabia and surrounding countries were conducted in children or teenagers using the ISAAC questionnaire. No data of asthma prevalence based on ECRHS are available in Saudi Arabia and surrounding countries with the exception of one study carried out in the United Arab Emirates. Mahboub BH et al[10] reported an asthma prevalence of 12.1% (95% CI: 10.4–14.1%) for all ages in the United Arab Emirates based on the ECRHS screening criteria.[10] Results from a national household survey conducted in Saudi Arabia in 2013 to estimate the burden of chronic medical conditions including asthma among Saudi population aged 15 years or older indicated the prevalence of a self-reported clinical diagnosis of asthma to be 4.05%.[5] The national survey underestimated the true asthma prevalence as it reported only self-reported asthma with the limitation of not using a validated screening questionnaire. It was carried out as part of national survey of other medical problems and included the elderly population where asthma screening requires a spirometry test due to the high prevalence of other chronic airway diseases which frequently overlap with asthma in this age group.

In comparing our results to that of other countries using the ECRHS questionnaire, the asthma prevalence is much higher in Saudi Arabia than in European countries. It was reported as 5.8-6.8% in Sweden, 2.1-4.4% in Germany, 3.5-5.5% in France, 7.5-8.4% in England, 2.9% in Greece, 3.3-4.5% in Italy and 2.1-6.3% in Spain.[11] It must be noted that these studies were conducted in the mid-nineties while the Saudi study was carried out in 2016. Moreover, the Saudi prevalence rate is for physician (ever) diagnosed asthma while the European prevalence rate is for diagnosed (current) asthma.

The high asthma prevalence found in the current study can be attributed to high allergen exposure in dust storms. Major dust storms are common in Riyadh; the average monthly deposition of dust in Riyadh is estimated to be 42 tons/km^2.[12] It is a common belief among the public that the air quality of Riyadh is poor,

contributing to a high frequency of asthma symptoms but this belief is not supported with scientific evidence as asthma prevalence usually multifactorial including increasing in asthma awareness, lifestyle changes and high allergens exposure to dust storms. However, in our opinion, dust storms are a major contributing factor to the high asthma prevalence reported in the current study. It is not known if the patients with asthma in Riyadh have high IgE levels or high prevalence of atopic predisposition, it is an exciting topic for future research. It is well known that lung injury in asthma and COPD have been linked to inhaling air particles less than 10 μm in diameter.[13] Gender differences in the prevalence of wheezing and asthma did not reach statistical significance, suggesting that the main contributor to the high asthma prevalence in Riyadh is related to environmental factors rather than to a genetic predisposition. However, this is only an assumption because we did not study the genetic factors contributed to asthma prevalence in our study population.

There were no significant differences between asthmatic vs. non-asthmatic participants in terms of geographical area of living (Residency) in Riyadh. Though there are differences in strength and frequency of dust storms among different parts of Riyadh in which the highest is in the north, but in the contrary, major industrial zones and factories in Riyadh located in the southern part of the city, which makes the net result equal exposure risk and equal prevalence rate in terms of residency.

Among asthmatic participants, the data revealed a high rate of uncontrolled asthma symptoms, the prevalence of waking up with a feeling of tightness was 33%, shortness of breath was 31%, coughing was 43%, and had an attack of asthma in the last 12 months was 5.6%. These are alarming and serious results indicating that asthmatic patients are not optimally controlled or receiving appropriate management. This is not a surprising finding as it is consistent with previous reports in which 64% of adults[14] and 59.3% of children[15] with asthma were uncontrolled. BinSaeed AA found that factors contributing to a high frequency of asthma symptoms were heartburn, chronic sinusitis, old age, daily tobacco smoking, low income, low education and unemployment.[16]

As expected, the current study revealed a high prevalence of nasal allergies which was associated with asthma symptoms. In a cross-sectional study conducted in secondary (high) schools in Riyadh, we reported a 59.9% prevalence rate of rhinitis symptoms in students with physician-diagnosed asthma.[3]

A possible limitation that should be noted is the cross-sectional survey design and possible bias due to self-report and subject recall bias. Moreover, even though we used disproportionate cluster sampling method, sample bias is possible in a cross sectional study even if we tried our best to minimize it.

The strengths of the study are a large and representative sample size using a standardized and validated screening questionnaire allowing comparison with other countries globally. In addition, a rigorous sampling technique was used with an excellent response rate.

In conclusion, the asthma prevalence is high in Riyadh and much higher than the prevalence reported in most countries using the ECRHS questionnaire. There is a need for comprehensive educational programs for healthcare workers as well as for patients and their families in terms of early diagnosis and an appropriate follow up plan for adults diagnosed with asthma. The findings of the study will support health policy makers in planning and utilizing healthcare resources.

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Statistics

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