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ORIGINAL RESEARCH

Prevalence and Risk Factors of Asthma Among Iraq Adults: A Cross-Sectional Study

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Purpose: Asthma is a chronic inflammatory airway disease that impacts millions of people worldwide. Understanding and reporting its prevalence and characteristic symptoms are essential for a comprehensive investigation of the disease.

Patients and Methods: This study aimed to assess the prevalence of asthma and asthma-related symptoms across Iraq. A cross-sectional study was conducted using the European Community Respiratory Health Survey (ECRHS) questionnaire. A questionnaire was created using Google Forms and distributed through various social networking sites.

Results: A total of 1131 participants were included in the study from different rural and urban Iraqi communities. The prevalence of physician-diagnosed asthma was 10.5%. The most commonly reported asthma symptom was waking due to an attack of coughing, reported by 60.9% of participants, followed by shortness of breath triggered by dust or fumes (45.9%) and waking due to shortness of breath (36.6%). Our results indicated that being a male, having allergic rhinitis and a family history of asthma is more like to have asthma according to physician diagnosis. Also, a significant association was found between asthma and having allergic rhinitis, food allergies, drug allergies and family history of asthma with asthma according to ECRHS.

Conclusion: This study highlights the prevalence of asthma and its associated symptoms among adults in Iraq, using the ECRHS questionnaire. The findings highlight the need for improved awareness, early diagnosis, and targeted interventions, particularly for high-risk groups such as older adults, smokers, and those with allergies. Further research is needed to explore environmental and genetic factors contributing to asthma prevalence in the region.

Keywords: allergic rhinitis, ECRHS questionnaire, physician diagnosis, food allergy

Introduction

Asthma is one of the most common respiratory diseases, characterized by chronic inflammation of the airways. It presents with variable and recurring symptoms, as the inflammation of the airways that causes partial obstruction of the small bronchi is reversible.[1] The inflammation is typically due to hypersensitivity and increased responsiveness of the bronchi to foreign bodies.[2] Asthma is increasingly prevalent in different countries worldwide, leading to higher rates of deaths and hospitalizations, in addition to affecting the patient's quality of life and various health systems.[3] Genetic predispositions and environmental triggers both play a role in the pathophysiology of asthma, with inflammatory cells such as eosinophils, mast cells, and T lymphocytes being critical to the development and persistence of asthma symptoms.[4] Key pathological features include inflammation of the small airways, increased mucus secretion, and structural changes known as airway remodeling.[5] Asthma is typically diagnosed through a combination of clinical evaluation and objective measurements of lung function parameters. Furthermore, nurse-led inhaler education has been shown to improve proficiency and adherence among asthmatic patients.[6] Asthma patients suffer from several respiratory symptoms, most notably wheezing, chest tightness, and shortness of breath, as well as coughing, which usually worsens at night or early in the morning. These symptoms can be intermittent or continuous and are often triggered by allergens, bacterial infections, and viruses that affect the respiratory

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system. This diversity of symptoms and triggers makes asthma difficult to control.[7] As mentioned, asthma can affect people of all ages, genders, and racial or ethnic backgrounds, and is influenced by genetic and environmental factors., However, the disease is more prevalent among children, especially school-age children. There are more than 300 million asthma patients worldwide. Despite medical and scientific developments, asthma remains undiagnosed and untreated in many people, leading to increased mortality and severe cases that require hospitalization.[8] In developed countries, the prevalence of asthma is higher, possibly due to increased urbanization and exposure to environmental pollutants. The prevalence of asthma in Iraq is significant, with notable impacts on the healthcare system and patients' quality of life.[9] Studies have shown that the highest prevalence of asthma in children was recorded in the capital, Baghdad (22.7%), while the lowest was in Erbil Governorate (7%). This discrepancy may result from differences in environmental conditions across Iraq.[9] In Saudi Arabia, asthma prevalence ranges from 9% to 33.7% among children and 10.5% to 18.3% among adults, according to various studies.[10,11] The prevalence of asthma in the UAE is approximately 13% among children, with a growing concern due to rapid urbanization and increased exposure to environmental pollutants.[12] Kuwait has reported a prevalence of asthma around 11.9% among children and adults.[13] Asthma prevalence in Jordan is estimated to be approximately 11.7% among adolescents.[14] Environmental exposures such as allergens, air contamination, socioeconomic status, and occupational irritants are critical risk factors. Lifestyle factors, including smoking, obesity, and diet, also influence asthma risk, as do comorbid conditions such as allergic rhinitis and gastroesophageal reflux disease (GERD). The relationship between asthma prevalence and allergy is characterized by a complex interplay of genetic, environmental, and immunological factors. Allergic asthma, atopy, and sensitization to allergens significantly contribute to the overall burden of asthma.[15] Despite the increasing global prevalence of asthma, there remains a lack of comprehensive epidemiological data in certain regions, including Iraq. Understanding asthma prevalence, its associated symptoms, and risk factors is crucial for improving disease management, guiding public health policies, and identifying vulnerable populations in need of targeted interventions. However, few studies have systematically assessed asthma prevalence in Iraq using validated international tools. Therefore, this study aimed to assess the prevalence of asthma using the European Community Respiratory Health Survey (ECRHS) questionnaire and to evaluate the prevalence of asthma symptoms among in Iraq, as well as to report the variables associated with asthma based on physician diagnosis and ECRHS.

Materials and Methods

Population and Study Design

According to the 2024 national census, Iraq's population is approximately 45.4 million, with a nearly equal gender distribution of about 50.1% males and 49.9% females.[16] The capital, Baghdad, remains the most densely populated city. This study employed an online cross-sectional design and was conducted across different regions of Iraq. The questionnaire was developed using Google Forms and distributed via popular social networking platforms such as Facebook, WhatsApp, Viber, and Telegram. This method allowed for broad outreach and inclusion of a diverse cross-section of the Iraqi population.

Ethical Approval

The purpose of the study was included in the informed consent form at the beginning of the questionnaire. The informed consent further confirmed the voluntary nature of the participation, with the ability to withdraw at any time point and the confidentiality of all collected data. This was done through a screening question at the end of the consent form 'Do you wish to participate in this study? And only those who selected 'Yes' proceeded to the rest of the questionnaire; those who selected 'No' were automatically exited. The questionnaire did not collect any identifying information and ensured participant anonymity. Ethical approval for the study was obtained from the Iraqi Ministry of Health (approval reference: 7/2022). This study was conducted according to the principals of the declaration of Helsinki.

Questionnaire

The European Community Respiratory Health Survey (ECRHS) questionnaire was translated into Arabic, as Arabic is the primary language spoken in Iraq. The content and accuracy of the translated questionnaire were verified. The ECRHS

is a large-scale, multicenter epidemiological study designed to investigate the prevalence, risk factors, and natural history of asthma, allergies, and other respiratory diseases among adults in Europe and other parts of the world.[17] This questionnaire has been widely used in research to assess asthma prevalence and symptoms in adults, as documented in previous studies.[18–20] The ECRHS includes several questions about a person's health status, such as whether they have experienced wheezing in the past 12 months' shortness of breath, chest tightness, or a cough without a cold or viral infection. It also assesses nocturnal coughing attacks, allergic rhinitis, asthma attacks in the past year, and whether the person is currently taking asthma medication. Additional questions were included to collect demographic and lifestyle information, such as age, gender, weight, height, educational level, monthly income, family history of asthma and chronic diseases, smoking status, and whether the participant lives with smokers. The questionnaire also determined whether the participant resided in an urban or rural area. Furthermore, participants were asked about other immune-related conditions, including food and drug allergies, eczema, and whether they had been previously diagnosed with asthma or were currently taking asthma medications.

Sample Size Calculations

Krejcie and Morgan's formula was used to calculate the minimum required sample size:[21]

$$S = X2NP\ (1 - P) + a2(N - 1) + X2P\ (1- P)$$

where S = required sample size, X2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841), N = the population size, P = the population proportion (assumed to be 50% to maximize the sample size) and d = the degree of accuracy expressed as a proportion (0.5). Krejcie and Morgan developed standardized sample size tables based on this formula.[21] This study assumed an infinite population to determine the required sample size. Accordingly, the minimum required sample size was 384, based on a 95% confidence level (CI) and a 5% margin of error.

Statistical Analysis

SPSS Version 26 was used to perform data analysis. Descriptive statistics were reported, with medians and interquartile ranges (25–75 percentiles) used for continuous variables, while percentages and frequencies were used for categorical variables. Two binary regression models were applied to evaluate variables associated with asthma, one based on physician diagnosis and the other on ECRHS scores. The models included age, gender, educational level, smoking status, monthly income level, residential area, family history of asthma, and whether participants had allergic rhinitis, food allergies, drug allergies, or eczema as predictors. Statistical significance was set at $p < 0.05$.

Results

The present study included 1131 participants (61.3% female), with more than half (51.9%) aged 20–30 years old. Regarding BMI, 31.3% were overweight and 21.4% were either obese or severely obese. Most participants held a bachelor's degree (48.5%) and reported a moderate monthly income (48.5%). The majority resided in urban areas (80.1%). Chronic diseases were reported by 16.8% of respondents, while 17.1% reported a family history of asthma. Most participants were non-smokers (85.3%), though 11% were current smokers. Notably, over one-third (35.7%) reported living with a smoker. Table 1 displays participants' sociodemographic profiles.

The prevalence of asthma-related variables among the study participants is shown in Table 2. About 45% of participants experienced shortness of breath due to dust or fumes, and 22.5% had food allergies.

Furthermore, most participants (60.9%) were woken up by coughing attacks, and 36.9% were woken up by shortness of breath. Finally, 35.5% of the participants had allergic rhinitis. The internal consistency of the ECRHS items was evaluated by computing Cronbach's alpha, with the results indicating good internal consistency (Cronbach's alpha = 0.73).

Two binary regression models were applied to identify the variables significantly associated with asthma prevalence (displayed in Table 3). The first model, based on physician diagnosis, indicated that women had significantly lower odds of having asthma (OR =0.438, 95% CI [0.266–0.721], p=0.001). Furthermore, participants who had allergic rhinitis

Table 1 Socio-Demographic Characteristics of the Study Participants

		Count (%)
Age	Under 20 years	57 (5%)
	20–30 years	587 (51.9%)
	31–40 years	294 (26%)
	Over 40 years	193 (17.1%)
Gender	Female	693 (61.3%)
	Male	438 (38.7%)
Body mass index	Underweight	30 (2.8%)
	Normal weight	475 (44.6%)
	Overweight	333 (31.3%)
	Obese	188 (17.7%)
	Severely obese	39 (3.7%)
Educational status	Diploma or lower	244 (21.6%)
	Bachelor's degree	548 (48.5%)
	Postgraduate degree	280 (24.8%)
Monthly income level	Low income	153 (13.5%)
	Moderate income	549 (48.5%)
	High income	429 (37.9%)
Residential Area	Rural	225 (19.9%)
	Urban	906 (80.1%)
Do you have any chronic diseases?	No	941 (83.2%)
	Yes	190 (16.8%)
Family history of asthma	No	930 (82.9%)
	Yes	192 (17.1%)
Smoking status	Non-smoker	965 (85.3%)
	Ex-smoker	42 (3.7%)
	Smoker	124 (11%)
Living with a smoker		404 (35.7%)

showed significantly higher odds of having asthma (OR =2.747, 95% CI [1.764–4.274], p<0.001), also participants who had a family history of asthma showed significantly higher odds of having the condition (OR =3.003, 95% CI [1.887-–4.762], p<0.001).

The second model, based on the ECRHS score, indicated that non-smokers had significantly lower odds of having asthma compared with smokers (OR =0.575, 95% CI [0.358–0.923], p=0.022). Furthermore, participants who had allergic rhinitis, food or drug allergies had higher odds of having asthma (OR =1.776, 95% CI [1.342–2.353], p<0.001; and OR =1.908, 95% CI [1.370–2.667], p<0.001; OR =1.848, 95% CI [1.276–2.674], p=0.001, respectively).

Table 2 The Prevalence of Asthma and Related Variables Among the Study Participants

	Count (%)
Physicians-diagnosed asthma	119 (10.5%)
Wheezing or whistling after physical exercises	226 (20%)
Shortness of breath due to dust/ fumes	515 (45.9%)
Eczema	104 (9.3%)
Food allergy	254 (22.5%)
Drug allergy	196 (17.3%)
Have you ever taken any medicine for asthma?	155 (13.7%)
ECRHS items:	
Wheezing or whistling at any time in the last 12 months	360 (31.8%)
Wheezing or whistling without cold	242 (21.4%)
Woken up with chest tightness	388 (34.3%)
Woken up by shortness of breath	417 (36.9%)
Woken up by an attack of coughing	689 (60.9%)
Asthma attack in the last 12 months	72 (6.4%)
Currently taking any medicine for asthma	71 (6.3%)
Have allergic rhinitis	402 (35.5%)

Finally, participants who had a family history of asthma had significantly higher odds of having asthma (OR =2.494, 95% CI [1.733–3.597], p<0.001).

Table 3. Binary regression analysis of variables associated with asthma based on physician diagnosis and ECRHS score.

Table 3 Binary Regression Analysis of Variables Associated with Asthma Based on Physician Diagnosis and ECRHS Score

		Asthma Based on Physician Diagnosis				**Asthma based on ECRHS Score**			
		OR	**P-value**	**95% C.I. for OR**		**OR**	**P-value**	**95% C.I. for OR**	
				Lower	**Upper**			**Lower**	**Upper**
BMI		1.000	0.935	1.000	1.000	1.000	0.708	1.000	1.000
Age	Under 20 years	0.408	0.206	0.102	1.635	0.979	0.959	0.440	2.179
	20–30 years	0.619	0.129	0.334	1.149	0.830	0.377	0.548	1.256
	31–40 years	0.763	0.399	0.407	1.430	0.783	0.255	0.514	1.193
	Over 40 years	(REF)							

(*Continued*)

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Table 3 (Continued).

		Asthma Based on Physician Diagnosis				Asthma based on ECRHS Score			
		OR	P-value	95% C.I. for OR		OR	P-value	95% C.I. for OR	
				Lower	Upper			Lower	Upper
Gender	Female versus male	0.438	**0.001**	0.266	0.721	1.043	0.801	0.752	1.446
Education status	Diploma or less	1.645	0.173	0.803	3.369	1.067	0.771	0.689	1.653
	Bachelor's degree	1.323	0.322	0.760	2.302	0.917	0.615	0.655	1.284
	Postgraduate degree	(REF)							
Smoking status	Non-smoker	1.153	0.696	0.565	2.352	0.575	**0.022**	0.358	0.923
	Ex-smoker	0.982	0.974	0.320	3.009	0.679	0.337	0.307	1.499
	Smoker	(REF)							
Monthly income level	Low income	0.851	0.662	0.413	1.754	1.152	0.536	0.736	1.802
	Moderate income	0.771	0.279	0.481	1.235	1.076	0.619	0.805	1.439
	High income	(REF)							
Residential Area	Rural versus Urban	1.109	0.724	0.624	1.971	0.881	0.497	0.611	1.270
Eczema	Yes versus No	1.089	0.808	0.546	2.174	0.724	0.179	0.451	1.160
Allergic rhinitis	Yes versus No	2.747	**<0.001**	1.764	4.274	1.776	**<0.001**	1.342	2.353
Food allergies	Yes versus No	1.538	0.083	0.946	2.500	1.908	**<0.001**	1.370	2.667
Drug allergies	Yes versus No	1.695	0.052	0.996	2.890	1.848	**0.001**	1.276	2.674
Family history of asthma	Yes versus No	3.003	**<0.001**	1.887	4.762	2.494	**<0.001**	1.733	3.597

Notes: Bold values indicate statistically significant associations ($p < 0.05$).
Abbreviations: BMI, Body mass index; ECRHS, European Community Respiratory Health Survey.

Discussion

This study examined the prevalence of asthma and associated symptoms among adults living in Iraq. The findings indicated that the estimated prevalence of asthma, as diagnosed by physicians, was 10.5%. This result is in line with previous reports from some regions of the UK, Australia, and New Zealand.[22] Compared to other countries in the Middle East, asthma prevalence in our study was lower than the rates reported in the United Arab Emirates (12.1%)[18] and Saudi Arabia (11.3%).[20] Importantly, the prevalence rates in this study were higher than those reported in Europe and North America, as well as in other large-scale cross-sectional epidemiological studies in the region, including SNAPSHOT, which reported an asthma prevalence of 7.3% in the Gulf cluster countries.[23] Moreover, in this study, asthma symptoms as mentioned in the ECRHS screening questionnaire ranged from 6.4% to 60.9%. These rates are higher than those previously reported in Saudi Arabia, which revealed that asthma symptoms ranged from 5.7% to 25.8%.[24]

The data from the present study showed that 6.3% of participants were on asthma medications, which is in line with a previous study conducted in Saudi Arabia, where 6.8% were on asthma medications.[24] Lower rates have been reported in other previous studies, with 2.2% of participants aged 20 to 44 years using asthma medications, as well as 4.7% and 3% in other studies, respectively.[25,26] In Turkey, Baççıoğlu et al reported a 2.6% prevalence,[27] while other studies showed a range of 1.3% to 5.1%, aligning with the present study's results.[28,29]

The prevalence of individual respiratory symptoms in our study population exceeded both the median proportions and distribution patterns observed in the original ECRHS data, which included 48 centers across 22 countries, including Europe, Scandinavia, Australia, and the US,[22] as well as those observed in a previous study conducted in Saudi Arabia.[24]

Specifically, our findings compared to the ECRHS as follows: wheeze (20% vs 20.7% and 18.9%, respectively), shortness of breath (45.9% vs 7.7% and 9.3%, respectively), wheeze without a cold (21.4% vs 9.3% and 10.9%, respectively), waking with chest tightness (34.3% vs 9.7% and 10.1%, respectively), waking with breathlessness (36.9% vs 4.7% and 8.9%, respectively), waking with cough (60.9% vs 25.6% and 23.9%, respectively), asthma attack (6.4% vs 2.6% and 5.7%, respectively), and allergic rhinitis /hay fever (35.5% vs 16.6% and 25.8%, respectively). These findings indicate that the prevalence of asthma identified using the ECRHS in our population was substantially higher than the rate of physician-diagnosed asthma.

Reports on asthma symptoms vary significantly. For example, the prevalence of wheezing across 70 countries averaged 8.6%, with China at 1.73% and Australia at 27.4%.[30] In Turkey, Pakistan, and the UAE, the prevalence of wheezing was 11.34%, 5.02%, and 7.21%, respectively.[18,29,31] This study found a higher wheezing prevalence of 20% among participants, which was higher than reported in some Asian countries but lower than in European countries. However, this prevalence was comparable to that of a previous study conducted in Iran (21.8%).[32]

This study also assessed the risk factors for asthma symptoms, including BMI, age, gender, smoking status, monthly income level, residential area, eczema, allergic rhinitis, food allergies, drug allergies and family history of asthma. Previous studies have reported that women are more susceptible to asthma than Previous studies have reported that women are more susceptible to asthma than men, as shown in a long-term ECRHS follow-up[33] and in a study by Stern et al conducted in the United States,[34] which found a higher incidence of asthma among women. According to the ECRHS, these findings suggest that asthma incidence may be partially influenced by gender. However, our results indicated that men were more likely to receive a physician-diagnosed asthma diagnosis, whereas this trend was not supported by the ECRHS assessment. These findings raise the possibility that men are over-diagnosed with asthma relative to women, potentially due to differences in symptom presentation and diagnostic biases. The overdiagnosis in men may also result from a greater reliance on symptom-based assessments rather than objective lung function tests, leading to unnecessary treatments and mismanagement of respiratory conditions. Further research is needed to validate these observations.

Being a smoker, having allergic rhinitis, food allergies, drug allergies and family history of asthma were associated with asthma according to ECRHS. In contrast, only allergic rhinitis and a family history of asthma were associated with physician-diagnosed asthma. These findings align with a previous study in Ethiopia, which reported that individuals with a family history of asthma and exposure to house dust or smoke were more likely to be diagnosed with the condition.[35] Importantly, our results are in line with a review report on asthma epidemiology and risk factors globally.[36]

Asthma presents a growing burden on Iraq's healthcare system, driven by increasing environmental risk factors such as dust storms and air pollution. Challenges such as underdiagnosis, limited access to respiratory care, and lack of nationwide screening programs further contribute to the health system strain. Strengthening asthma surveillance, expanding access to diagnosis and treatment, and addressing environmental triggers through public policy are essential steps to reduce the disease burden and improve patient outcomes.

Strengths and Limitations

This study is strengthened by its large, population-based sample, and the high response rate among participants who completed the questionnaire. To our knowledge, this is also the first study to implement the ECRHS questionnaire in Iraq.

However, the study has some limitations. Although the sampling method incorporated random selection, its reliance on convenience sampling may have introduced unintended selection bias. Additionally, the response may have introduced significant selection bias by overrepresenting individuals with a social media presence. As a result, the estimated asthma prevalence in the study population may have been either overestimated or underestimated. The ECRHS questionnaire relies on self-reporting, requiring respondents to recall symptoms over the past 12 months, which may introduce both recall and response bias. While this study did not directly assess participants' comprehension of the questionnaire, cultural appropriateness and comprehensibility were inferred from the statistical equivalence of our findings with previously published data. Lastly, the study sample was recruited from a single city in Iraq, which may

limit the generalizability of the findings, particularly for rural populations. Nevertheless, overall, the questionnaire's internal consistency, reliability, and strong clinical validation suggest that it is both appropriate and effective.

Conclusion

This study provides the first large-scale assessment of asthma prevalence in Iraq using the ECRHS questionnaire. The results reveal a significant burden of asthma and associated symptoms, many of which may go undiagnosed. Key risk factors identified include smoking, allergic conditions, and specific demographic characteristics. These findings emphasize the need for enhanced asthma awareness, early detection, and tailored public health interventions. Future research should adopt broader, more representative sampling and incorporate clinical evaluations to improve accuracy and guide national asthma management strategies.

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