Original Article

Prevalence and factors associated with adult bronchial asthma in Aseer region, Southwestern Saudi Arabia

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Abstract:

BACKGROUND: Bronchial asthma (BA) is one of the most common chronic respiratory diseases in Saudi Arabia (SA). Most of the studies investigating the prevalence of BA in SA have focused on children and its exact prevalence in adults is unknown.

OBJECTIVES: The objective of this study is tto investigate the prevalence and factors associated with adult BA in Aseer region, southwestern SA.

METHODS: A cross-sectional study was conducted on a representative sample of adults who attended primary health care centers. A validated Arabic version of the International Study of Asthma and Allergies in Childhood questionnaire was used. The presence of wheeze in the past 12 months was used as a proxy for BA.

RESULTS: The study included 960 adults. The prevalence rate of BA was 19.2% (95% confidence interval [CI]: 16.72–21.80). In a multivariable analysis, the following factors were significantly associated with BA in adults; living in low-altitude areas (adjusted odds ratio [aOR] = 1.51, 95% CI: 1.04–2.21), being in rural areas (aOR = 1.58, 95% CI: 1.12–2.23), using analgesics (aOR = 1.52, 95% CI: 1.06–2.20), residing near heavy trucks traffics (aOR = 1.67, 95% CI: 1.13–2.46), having cats in the house (aOR = 2.27, 95% CI: 1.30–5.94), and being aged 55–64-year-old (aOR = 1.94, 95% CI: 1.02–3.69).

CONCLUSION: The prevalence of BA was high, affecting one-fifth of adults in Aseer region. The study revealed some modifiable factors significantly associated with BA in adults. There is a need to improve asthma control programs at the primary health-care level, particularly at rural and at low-altitude areas, and more focus should address the elders. In addition, enhancing community-based health promotion programs tackling the identified modifiable factors of BA are required.

Keywords:

Adults, Aseer region, bronchial asthma, factors, prevalence

Bronchial asthma (BA) is one of the most common chronic respiratory diseases affecting adults and children in Saudi Arabia (SA).[1-4] There are now reports that BA is a common chronic disease and local reports suggest that its prevalence is increasing.[5] Despite these observations, several epidemiological aspects of asthma and its related clinical features, although partially addressed[6,7] are not yet settled.[8] This have impacted the way the disease is diagnosed and managed.[9]

In this respect, Aseer region, southwestern SA, may present a special case. This area is characterized by a special geography comprising high-altitude mountainous areas, low-altitude valleys, agricultural landscapes, as well as sea level planes.[10] In addition, people who inhabit these areas share certain customs and

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traditions which may affect the epidemiology of asthma or its management.[4,5,11,12]

In general, the risk factors for mild or obstructive asthma in the kingdom can range from patient-related factors, for example, age, gender, obesity, smoking, exercise, stress, level of education, and the use of medicinal drugs. Other factors are environmental which include air pollution, sandstorms, weather changes, altitude, urban versus rural dwelling, and the presence of animals in and around the houses.[2,12-15]

Most of the studies investigating the prevalence of asthma in SA have focused on children, and the exact prevalence of this disease in adults is unknown.[5] These studies showed the prevalence of asthma in children to be in the range between 8% and 25%.[16,17] Some of these studies indicated a recent and an alarming increase in the prevalence rates over the past three decades.[6,18,19] This may be attributed to the rapid changes in the lifestyle related to the modernization of the Saudi society, increased exposure to environmental factors such as indoor/outdoor allergens, dust, sandstorms, and tobacco smoking and air pollution.[2] Another explanation has attributed the increased prevalence to the hygiene hypothesis, which proposes that there is a lack of sufficient microbial exposure early in life due to pharmacological manipulations and vaccines.[5] The present study investigated the prevalence and factors associated with adult BA in Aseer region, southwestern SA.

Methods

Design

A cross-sectional study was conducted on a representative sample of adults in Aseer region, Southwestern SA.

Description of the study area

Aseer region extends from a high mountain chain called Sarawat down to the eastern coast of Red Sea. To the west of these mountains is a very narrow Red Sea coastal plain "Tehama." The climate in these areas is variable depending on the altitude and proximity to the sea.[10] Health-care facilities in the study area include 23 hospitals and 247 primary health care centers (PHCCs) (Saudi MOH portal November 2014).

Target population

Adult males and females who attended any of the selected PHCCs for any reason were the targeted groups for the study. They included apparently healthy persons attending the centers accompanying other family members for services such as antenatal care, immunization, well baby clinics, dental care, chronic disease clinics, first aids, and premarital counseling services. Definition of an adult is someone who is 20 years old or over. Using the WHO manual for sample size determination in health studies,[20] with a conservative anticipated proportion of 10%,[6] and absolute 2% precision at 95% of confidence interval (CI), the minimal sample size required for the study was calculated to be 865 adults.

Exclusion criteria

The following were considered as exclusion criteria:

1. Patients with a history of recent respiratory tract infection, individuals with a history of current or just recovering from fever, cough, and flu-like symptoms
2. Individuals with ≥20 pack-years of cigarettes smoking. For Shisha smoking, the shisha smoking index (SSI) was calculated by the number of times of Shisha smoking per week multiplied by the average number of Korsis (Hagar) smoked each time. Individuals with SSI of ≥16 were also excluded[21]
3. Patients who were already diagnosed with chronic lung disease other than asthma, for example, bronchiectasis, chronic obstructive pulmonary disorder, interstitial lung disease, and old tuberculosis infection.

Sampling technique

Five PHCCs were randomly selected. Since the risk factors and prevalence of asthma are more likely to be affected by the environment, the selection of these PHCCs took into account their urban, rural, low- and high-altitude locations. The selected centers were Al Manhal (urban at an altitude of 2300 m above sea level), Al Mowazafin (urban at an altitude of 2300 m), Muhayel (urban at an altitude of 400 m), Tharaban (rural at an altitude of 200 m), and Al Sooda (urban at an altitude of 3200 m).

Data collection sheet

The study used a validated Arabic version of the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire that suitably modified to fit our adult survey. This questionnaire was used for all-age adults because our study aimed at studying all adult asthma in the study areas. The modified Arabic translated ISAAC questionnaire for adults was validated and used in the assessment of Asthma prevalence among adults in Sudan.[22] A study comparing ISAACC questionnaire and the European Community Respiratory Health Survey (ECRHS) found a strong correlation between the ISAAC and ECRHS prevalence data for adults.[23] The "presence of wheeze in the past 12 months when not having cold" as stated in the ISAAC questionnaire for asthma was used as a proxy for BA prevalence. This criterion is widely used and well accepted in epidemiological studies.[24]

The data collection form included: written consent, demographical data, asthma Questionnaire, environment

exposures as type of housing, fuel used in cooking and heating, and animals inside the house.

Field visits

Scheduled visits to the selected centers were arranged by the study field teams. During such visits, adult males and females attending the selected PHCCs for any reason were invited to participate in the study. A signed informed consent is obtained from each patient before inclusion in the study. Inclusion and exclusion criteria were taken into consideration.

Data analysis

The compiled data were validated and analyzed using the SPSS Software program version 22 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp). Frequency and 95% CIs were used to present asthma prevalence. Univariate and binary logistic multivariable regression were used to identify potential factors associated with asthma. Crude odds ratios and adjusted odds ratios (aOR) and their concomitant 95% CI were used to present the results. Variables included as potential risk factors in the logistic regression model were gender, age group, altitude, residence, ever smoking, using analgesics, body mass index, the presence of heavy trucks traffic outside, the use of wood for heating and cooking, and the presence of sheep, goats, camels, cats, and dogs.

Results

Description of the study sample

The present study included 960 adults. Table 1 shows the personal and housing characteristics of the study sample. The sample included 714 males (74.4%) and 246 females (25.6%). The age ranged from 20 years to 95 years, with an average of 39.43 ± 14.63 years and a median of 36 years. The majority were secondary and higher educated (585, 60.9%). Illiterate were few (142, 14.8%). The most frequent occupations were office workers (333, 34.7%) and manual workers (204, 21.3%). Ever smoked were 30.5% (293), and obese and overweight were 68.1% (654).

Regarding altitude, the sample included 446 persons from high-altitude areas (47.5%), and 514 from low-altitude areas (53.5%). As far as rural-urban differences, the study included 492 adults from urban areas (51.3%) and 468 from rural areas (48.7%).

The majority of the samples were living in concrete houses (734, 76.5%) and the rest were living in traditional houses (226, 23.5%). The majority had electricity (949, 98.9%) and had no animals at their houses (618, 64.4%).

Table 1: Personal and housing characteristics of the study sample (960) in Aseer region, southwestern Saudi Arabia

Characteristics	*n* (%)
Sex	
Male	714 (74.4)
Female	246 (25.6)
Age (years)	
18-24	146 (15.2)
25-34	280 (29.2)
35-44	212 (22.1)
45-54	148 (15.4)
55-64	107 (11.1)
65+	67 (7.0)
Education	
Illiterate	142 (14.8)
Elementary	140 (14.6)
Intermediate	93 (9.7)
Secondary	248 (25.8)
University	329 (34.3)
Postgraduate	8 (0.8)
Occupation	
Office worker	333 (34.7)
Teacher	64 (6.7)
Retired	119 (12.4)
Farmer	28 (2.9)
Shepherd	13 (1.4)
Private business	56 (5.8)
Homemaker	143 (14.9)
Manual workers	204 (21.3)
Ever smoked	
No	667 (69.5)
Yes	293 (30.5)
BMI categories	
Normal	306 (31.9)
Overweight and obese	654 (68.1)
Altitude	
High	446 (46.5)
Low	514 (53.5)
Residence	
Urban	492 (51.3)
Rural	468 (48.7)
Housing	
Concrete	734 (76.5)
Traditional (old house)	226 (23.5)
Electricity	
No	11 (1.1)
Yes	949 (98.9)
Air conditioning	
No	171 (17.8)
Desert	16 (1.7)
Freon	773 (80.5)
Having any animal at home	
No	618 (64.4)
Yes	342 (35.6)

BMI=Body mass index

Prevalence of adult bronchial asthma

The present study showed that 184 adults reported having wheeze in the past 12 months when not having a cold giving a prevalence rate of BA of 19.2% (95%

CI: 16.72–21.80). The prevalence of BA among males amounted to 18.3% (95% CI: 15.57–21.39) and among females amounted to 21.5% (95% CI: 16.57–27.21). The presence of an overlap in the 95% CI in males and females, indicated a nonsignificant statistical difference by gender.

Factors associated with adult bronchial asthma

Table 2 shows the univariate and multivariable analysis of personal and environmental outdoor and indoor factors associated with BA. In multivariable analysis, some factors were found to be significantly associated with BA. Adults living at low-altitude areas had significantly more risk to develop BA compared to those living at high-altitude areas (aOR = 1.51, 95% CI: 1.04–2.21). Those living in rural areas (aOR = 1.58, 95% CI: 1.12–2.23), using analgesics (aOR = 1.52, 95% CI: 1.06–2.20), and living near heavy trucks traffic streets (aOR = 1.67, 95% CI: 1.13–2.46) had high risk to develop BA. Having cats in the house was found also as a significant factor for BA (aOR = 2.27, 95% CI: 1.30–5.94). Similarly, adults aged 55–64-year-old (aOR = 1.94, 95% CI: 1.02–3.69) were also at high risk.

Discussion

Local reports suggest that the prevalence of BA is increasing in southwestern SA.[6] The present study in Aseer region showed that 184 adults reported having wheeze in the past 12 months giving a prevalence rate of BA of 19.2% (95% CI: 16.72–21.80). A study investigating the prevalence of asthma among 16–18 years adolescents attending high schools in the city of Riyadh, utilizing the ISAAC questionnaire tool (similar to our study) found a comparable prevalence of wheeze during the past 12 months of 18.5%.[25] Another study using the ECRHS questionnaire performed in Riyadh among Saudi patients aged 20–44 years found similarly a prevalence of wheezing in the past 12 months of 18.2%.[2]

A meta-analysis on the variation in the prevalence of asthma in different regions in SA showed an elevation in the BA prevalence from 1990 to 2000 with steadiness in the prevalence of asthma since 2000. The pooled weighted prevalence rate of asthma was 14.3% (95% CI: 13.4–15.2).[26]

In other countries, high figures were also reported among adults in Kuwait (15%), Sudan (15.5%), and Qatar (19.8%).[27] Similarly, in other western countries, a prevalence of "wheezing symptoms" of 74.4, 254.8, and 123.4/1000 adults in Ukraine, Kazakhstan, and Azerbaijan, was found, respectively.[28] A study in India found a prevalence of BA of 9.9% (95% CI = 7.53%–12.27%).[29]

In the present study, the following factors were significantly associated with BA in adults; living in low-altitude areas, being in rural areas, using analgesics, residing near heavy trucks traffic streets, having cats in the house, and being aged 55–64-year-old.

Our results indicated that living in low-altitude areas was associates with a higher prevalence of BA as compared to high-altitude areas. This observation was previously reported in our region[6] and noted in other parts of the world.[30] This may be explained by the lower allergenic potential in higher altitudes.[30] It is believed that allergens density may differ by altitude level, which may impact climate features in a region and therefore, impact bronchial sensitization. While adverse effects of high-altitude living were reported for asthmatic children in the tropics,[31] beneficial effects and treatment gains have been cited for adults living in high altitudes.[32] The later may be comparable to our situation in Aseer region, where the high-altitude climate is similar or approaches temperate regions.

The present study found that living in rural areas was significantly associated with BA in adults. Rural-urban differences have been observed worldwide[33] and not withstanding SA.[7] Factors that influence the disparity of asthma prevalence in rural versus urban are wide ranging and they include urbanization itself with indoors living and its environmental factors being the most important. In this respect, sensitization elements such as smoking, indoor air pollution, humidity, increased the use of analgesics, the use of floor carpeting, the presence of house dust mites, and other factors associated with urbanization.[34] However, in our study, multivariate analysis of our data revealed a different situation with people living in rural areas showing increased sensitization to BA. The aeroallergen potential is greater and an important factor in the rural environment.[35]

In multivariable analysis, the present study found that using analgesics was significantly associated with BA in adults. The adverse effects of the use of analgesics in asthmatics are well reported. The culprits are aspirins, paracetamol, and other nonsteroidal anti-inflammatory drugs.[36] The use of the anti-inflammatory agents in exacerbation of BA in individuals with mild asthma and their role in the etiology of BA in adults is not very well understood. The use of aspirin has been implicated, and a number of hypothesis has been put forward.[37] Similar arguments have been put forward with regard to the use of acetaminophen (paracetamol) in both children and adults.[38]

The present study showed that residing near heavy trucks traffic streets (as a proxy of outdoor pollution) was a significant factor associated with BA in adults. There is now considerable evidence that traffic and outdoor pollution are important factors in new set asthma as well as exacerbating preexisting asthma. Particulate matters

Table 2: Univariate and multivariable analysis of personal and environmental outdoor and indoor factors associated with adult asthma in Aseer region, southwestern Saudi Arabia

Personal and environmental factors	No-asthma group, *n* (%)	Asthma group (wheeze in the past 12 months), *n* (%)	cOR (95% CI)	aOR (95% CI)
Sex				
Males	583 (81.7)	131 (18.3)	Reference	Reference
Females	193 (78.5)	53 (21.5)	1.22 (0.85-1.75)	1.38 (0.92-2.08)
Age (years)				
18-24	120 (82.2)	26 (17.8)	Reference	Reference
25-34	241 (86.1)	39 (13.9)	0.74 (0.43-1.28)	0.77 (0.44-1.37)
35-44	171 (80.7)	41 (19.3)	1.10 (0.64-1.91)	1.21 (0.67-2.18)
45-54	119 (80.4)	29 (19.6)	1.12 (0.62-2.02)	1.14 (0.60-2.16)
55-64	77 (72.0)	30 (28.0)	1.79 (0.99-3.27)	**1.94 (1.02-3.69)**
65+	48 (71.6)	19 (28.4)	1.83 (0.93-3.61)	1.78 (0.87-3.65)
Altitude				
High	375 (84.1)	71 (15.9)	Reference	Reference
Low	401 (78.0)	113 (22.0)	**1.49 (1.07-2.07)**	**1.51 (1.04-2.21)**
Residence				
Urban	416 (84.6)	76 (15.4)	Reference	Reference
Rural	360 (76.9)	108 (23.1)	**1.64 (1.19-2.27)**	**1.58 (1.12-2.23)**
Ever smoking				
No	537 (80.5)	130 (19.5)	Reference	Reference
Yes	239 (81.6)	54 (18.4)	0.93 (0.66-1.32)	1.04 (0.71-1.52)
Using analgesics				
No	294 (84.7)	53 (15.3)	Reference	Reference
Yes	482 (78.6)	131 (21.4)	**1.51 (1.06-2.14)**	**1.52 (1.06-2.20)**
BMI				
Normal	248 (81.0)	58 (19.0)	Reference	Reference
Overweight and obesity	528 (80.7)	126 (19.3)	1.02 (0.72-1.44)	94.0 (0.64-1.38)
Trucks outside				
No	660 (82.0)	132 (18.0)	Reference	Reference
Yes	176 (77.2)	52 (22.8)	1.34 (0.93-1.93)	**1.67 (1.13-46.2)**
Wood for heating				
No	762 (80.8)	181 (19.2)	Reference	Reference
Yes	14 (82.4)	3 (17.6)	0.90 (0.26-3.17)	77.0 (0.20-95.2)
Wood for cooking				
No	763 (81.1)	178 (18.9)	Reference	Reference
Yes	13 (68.4)	6 (31.6)	1.98 (0.74-5.29)	26.1 (0.43-3.70)
Sheep and goats				
No	571 (83.4)	114 (16.6)	Reference	Reference
Yes	205 (74.5)	70 (25.5)	**1.71 (1.22-2.40)**	1.37 (0.91-2.05)
Camels				
No	745 (81.0)	175 (19.0)	Reference	Reference
Yes	31 (77.5)	9 (22.5)	1.34 (0.57-2.64)	0.92 (0.39-2.18)
Cats				
No	745 (81.5)	169 (18.5)	Reference	Reference
Yes	31 (67.4)	15 (32.6)	**2.13 (1.13-4.04)**	**2.77 (1.30-5.94)**
Dogs				
No	763 (80.9)	180 (19.1)	Reference	Reference
Yes	13 (76.5)	4 (23.5)	1.30 (0.42-4.05)	0.43 (0.11-1.68)

No asthma group is free of any asthma responses. Bold 95% CIs are statistically significant. cOR=Crude odds ratio, aOR=Adjusted odds ratio for other studied personal and environmental factors, 95% CIs=95% confidence intervals, BMI=Body mass index

such as diesel exhaust particles, road dust, tire wear, and brake wear, and gaseous emissions including nitrogen oxides are all implicated. This may be explained by the possible interaction of outdoor air pollutants with the respiratory tract and the immune system.[39]

The present study showed that having cats was significantly associated with BA in adults. Although it has previously been reported worldwide that the presence of cats and dogs in and around the house is associated with increased prevalence of asthma in

children; nonetheless, this association was not clear for adults. This concept has recently been challenged, and indeed such association has been demonstrated.[40] However, such notion should be counterbalanced with studies which propose a protective effect of exposure to cats and dogs as pets in earlier childhood, a concept not far removed from the hygiene hypothesis with regards to infection.[41]

In multivariable analysis, the present study found that adults aged 55–64-year-old were significantly at risk to have BA. This finding is in agreement with previous reports indicating an association of asthma with older age and citing asthma morbidity in people over 55 years of age.[42] Of note is that a specific asthma phenotype termed "Geriatric asthma" is now being ascribed to people of older age.[43]

Limitations of the study are mostly related to two issues; the inclusion of adult persons attending PHCCs and the use of the history of a wheeze during the past 12 months as a proxy of BA. They may have resulted in an overestimation of the true prevalence of asthma.

Conclusion

One out of each five adults in Aseer region suffers from BA. The following factors are significantly associated with BA in adults; living in low-altitude areas, being in rural areas, using analgesics, residing near heavy trucks traffic streets, having cats in the house, and being aged 55–64-year-old. There is an urgent need to improve asthma control programs at the primary health-care level, particularly at rural and at low-altitude areas, and more focus should address the elders. In addition, enhancing community-based health promotion programs tackling the modifiable factors of BA as misuse of analgesics, outdoor pollution, cats in and around houses are needed. There is still continuous recommendation to continue epidemiological studies and nationwide research in this field.

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Conflicts of interest

There are no conflicts of interest.

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