

Childhood asthma in Qatar: A literature review

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Abstract

Review Article

Background: Asthma is one of the most common serious global health problems affecting all age groups in the world. Its prevalence is increasing in many countries, especially among children. This paper aims to cover the current status of childhood asthma in the State of Qatar. **Methods:** An extensive review of studies published from 1989 to 2019 (30 years) in the area of childhood asthma was conducted with the use of PubMed and Google Scholar, using the key terms; childhood, asthma, Qatar. We also used the reference list of all retrieved articles, related articles and author names to expand our search that was used for this review. **Results:** Retrieved articles state that the prevalence of asthma in the Middle East is lower than in most developed countries. However, there is not enough longitudinal data to estimate the trend over time. The estimated prevalence of asthma in the Middle Eastern children aged 13-14 years was 7.57%. The minimum prevalence rate of asthma in the Middle East (0.7%) was observed in Isfahan in Iran, and the highest 22.3% was reported from Bagdad in Iraq. The diagnosed prevalence of asthma among Qatari school children was 19.8 %, which is very close to that in the neighbouring Gulf Country Oman, 20.7 %. **Conclusion:** This review emphasizes the importance of research on childhood asthma in Qatar to capture the baseline data and the need for Health policymakers to implement clinical control measures to lessen the burden of asthma in children in the state of Qatar.

Keywords: Literature review, childhood, asthma, Qatar.

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INTRODUCTION

Bronchial asthma is one of the most common chronic diseases with a varying age of onset, affecting all age groups. Whilst recent reports indicate an increasing prevalence, especially among children, the accuracy of reporting, is difficult to ascertain. In 2014, the Global Asthma Report [1] estimated that 334 million people have asthma. The report also projected an additional 100 million new cases by 2025. Early detection and improved health care have resulted in a decline in hospitalizations and deaths from childhood asthma in some countries, yet the burden on health care systems [1-3] and economic costs to society through the loss of productivity in the workplace and disruption to the quality of family life remain unacceptably high [1].

In some industrialized countries, asthma and related allergies affect more than one-third of the child population [3, 4] although it remains unclear whether these are real-term increases in prevalence, the result of a higher level of awareness and better detection rates or a combination of the two [4]. Prevalence of asthma in

the Middle East is lower than in most developed countries. However, there is not enough longitudinal data to estimate the trend over time. The estimated prevalence of asthma in the Middle Eastern children aged 13-14 years was 7.57% (95% CI: 6.38-8.75). The minimum prevalence rate of asthma in the Middle East (0.7%) was observed in Isfahan in Iran, and the highest 22.3% was reported from Bagdad in Iraq [5]. The diagnosed prevalence of asthma among Qatari school children was 19.8 %. It is very close to that in the neighbouring Gulf Country Oman, 20.7 % [6].

Children's asthma is a main clinical concern around the world that imposes a great burden on families and society. The disease can impede the academic development and social activities of the children. Children's asthma is a burden on the health care system due to successive referrals to General practitioners and Hospitals which costs a lot [7, 8]. Due to the lack of a standard method for asthma diagnosis, examining the prevalence of asthma over time [9] was difficult. The International Study of Asthma and Allergies in Children (ISAAC) was established in 1991

to provide reliable data on the prevalence of the disease, its symptoms and changes during the time and in different countries. In the first phase children in the age group of 13-14 years in 56 countries, and the age group of 6 to 7 years in 38 countries were evaluated from 1994 to 1995. The second phase of ISAAC aimed to investigate risk factors of the disease in 1998; only 22 countries participated, and no Middle Eastern countries were involved. Several Middle Eastern countries took part in various phases of ISAAC. However, no systematic review was published from these studies [10].

In a recent systematic review, which includes eighteen countries of the Middle East including Qatar, reported that the prevalence of asthma in the Middle East is lower than many developed countries such as the UK (25.9%), Spain (12.8%), Australia (31%), and also Turkey (17.8%). However, it is higher than some developing countries like Tibet area in China (1.1%), India (4.9%) and Taiwan (6%) [5]. It also shows that the prevalence of asthma is higher among younger boys. However, the difference decreases between the two sexes in early adolescence.

Another systematic review by Pearce *et al.* reported that across 35 countries of the world, the prevalence of asthma in 21 countries (60%) is higher in the older age group and in nine countries (25.7%) it is higher in the younger age group. It was reported in 10 countries (25.7%) that the difference was insignificant, and in only 5 countries the prevalence of asthma was higher in the 6 to 7 years age group including; Iran and Oman [4].

Each year, children younger than 18 years of age account for a large portion of emergency department visits and hospitalizations due to asthma exacerbations. The magnitude of the impacts of asthma in children is illustrated by the fact that asthma accounts for more hospitalizations in children than any other

chronic illness. Moreover, asthma causes children and adolescents to miss school and causes parents to miss days at work. As might be expected, asthma also accounts for more school absences than any other chronic illness [1, 11].

We do not have any reliable baseline information on the prevalence of asthma in Qatar. Limited studies have been reported from Qatar, it was conducted between the periods of 1989 -2019. These studies were conducted mainly in secondary and tertiary care settings and only three studies were conducted in the primary care and the data provided was incomplete. Overall there is no existing data in Primary Care to estimate the trend over time. So, it is important to find out the information available in the literature to plan further studies on this topic. This study aims to provide an up to date status of the literature available on childhood asthma in Qatar.

METHODOLOGY

An extensive review of articles published in the last 10 years in the area of childhood asthma was conducted with the use of PubMed and Google Scholar, using the key terms; childhood, asthma, Qatar. A very limited number of publications were retrieved during this period and we included all studies retrieved through this search. The first study on this topic was published in 1989 and we retrieved only 17 publications till 2019 (over 30 years). We also used the reference list of all retrieved articles to expand our search for this review. This search was limited only to studies on childhood asthma conducted in Qatar. Only 17 research studies were found under this category, few of these studies are focusing on the association of asthma and obesity and few about the allergy, respiratory tract infections, bronchiolitis and cystic fibrosis in children. Below is the detailed description of each of the studies that were found relevant to this literature review.

Table-1: Provides a summary of all reviewed studies

Author(s)	Objective(s)	Sample	Design	Measurements	Findings
Dawod and Hussain[13]	To study the profile of asthmatic children in Qatar and compare it with other countries	n = 414 boys and girls, 7 months to 12 years old. There were 135 girls and 279 boys.	Retrospective cross-sectional	It consists of detailed clinical questionnaires, physical examinations, and laboratory evaluations.	Viral respiratory infections were the most common precipitating factor (95.17%). Fumes were incriminated as a triggering factor in 36% of patients with Bokhour representing 54% of them.
Osundwa and Dawod [12]	To report vomiting as a dominant symptom in a patient with acute asthma	1	Case report	Case report presentation	It is suggested that acute asthma be included in the differential diagnosis of recurrent and/or severe vomiting in children.

Sattar <i>et al.</i> [14]	To characterize the most frequent indoor and outdoor respiratory allergens involved in bronchial asthma and allergic rhinitis in the State of Qatar.	n=1106 whom 607 were females and 499 were males and their mean was age 30 years (12-48).	A hospital-based prospective study	Skin Prick Test [SPT] was performed on 1106 patients for common allergens whom The blood sample was taken for measuring specific IgE concentration	This study showed the dominance of house dust mites, pollen, grasses which are more or less same to other countries with similar and even with a different climate. Reduced exposure to these agents will help control raising the severity of these diseases.
Bener <i>et al.</i> [15]	To determine whether exposure to pets and domestic animals plays a significant role in the development of asthma and allergic rhinitis among the Qatari population	n=1106 whom 607 were females and 499 were males and their mean was age 30 years (12-48).	A hospital-based prospective descriptive study	Skin Prick Test (SPT) was performed on 1106 patients for common allergens whom the blood sample was taken for measuring total IgE concentration	In the present study, the prevalence of asthma, rhinitis, and skin allergy was significantly more common in families with animals than in those without
Bener <i>et al.</i> [16]	To assess the relationship between breastfeeding and the development of childhood asthma and allergic diseases in Qatari children at age 0-5 years. Additionally, this study investigated the effect of prolonged breastfeeding on allergic diseases in a developing country.	n=1500 Qatari infants and pre-school children with age range of 0-5 years and mothers aged between 18 to 47 years were surveyed	Cross-sectional survey	A questionnaire including allergic rhinitis, wheezing, eczema, and additional questions including mode and duration of breastfeeding, tobacco smoke exposure, number of siblings, family income, level of maternal education, parental history of allergies.	The study indicates that exclusive breastfeeding prevents the development of allergic diseases and asthma in children.
Ehlayel <i>et al.</i> [17]	To assess the effect of EBF on the development of allergic diseases and eczema in a developing country.	n=1500 Qatari infants and pre-school children with age range of 0-5 years and mothers aged between 18 to 47 years were surveyed	Cross-sectional survey	A questionnaire including allergic rhinitis, wheezing, eczema, and additional questions including mode and duration of breastfeeding, tobacco smoke exposure, number of siblings, family income, level of maternal education, parental history of allergies.	In children of developing countries, prolonged breastfeeding reduces the risk of developing allergic diseases and eczema even in the presence of a maternal allergy, where it might be a practical, effective preventive measure.
Bener <i>et al.</i> [18]	To determine the effect of polluted environment on	The study based on age, sex, and ethnicity of 716	Case and control study.	Questionnaires were used to collect the data of the school	This study provides some evidence that exposure to outdoor air

	extrinsic of asthma and allergic diseases among school children	cases (with asthma) and 716 controls (without asthma) school children living in both urban and in industrially polluted with an oil refinery and chemical pollutant.		children. It included information about: socio-demographic characteristics; respiratory symptoms; associated respiratory illness; family history of allergic diseases among first-degree relatives of asthmatic children	pollutants increases the risk of childhood asthma and allergic diseases in schoolchildren. The results are consistent with the hypothesis that long term exposure to nitrous oxide and carbon monoxide levels suggests that emissions from photochemical air pollution and oil refinery contribute to adverse health effects in Qatar
Bener <i>et al.</i> [19]	The objective of this study was to investigate the genetic and environmental risk factors associated with asthma among Qatari school children aged 6-12 years	n =3500 children were targeted for this study. 51.9% were boys and 48.1% girls. Their mean age was 8.92 +/- 1.89. The multistage sampling design was used.	Cross-sectional study	Questionnaires were used to collect the data of the school children between Feb 2003 and Feb 2004	His study revealed that the family history of asthma contributed more to childhood asthma than indoor and outdoor environmental factors. Boys were found more asthmatic than girls.
Bener <i>et al.</i> [20]	To determine the impact of asthma and air pollution on school attendance of primary school children 6 to 12 years of age in Qatar. :	n = 31,400 Qatari school children at the primary school (16,130 boys and 15,270 girls) 6 to 12 of age were studied to investigate school absenteeism caused by asthma and wheezing during the academic year October 2003 to July 2004.	Cross-sectional population-based study.	School Health Registry used for obtaining the student information and school absenteeism due to asthma and wheezing	Children with known asthma miss more days of school than those who do not have asthma. This study finding shows that air pollution has an impact on asthma, which results in significant school absenteeism
Janahi <i>et al.</i> [21]	To determine the prevalence of asthma and allergic diseases among schoolchildren aged 6-14 years in the State of Qatar,	n =3,283 school children living in both urban and rural areas (average age, 9.03 +/- 1.99 years; 52.3% boys and 47.7% girls) was conducted between February 2003-February 2004.	Cross-sectional study	A questionnaire designed by the International Study of Asthma and Allergy in Childhood (ISAAC)	Genetic factors related to the high rates of consanguinity may play an important role in the high prevalence rates noted in the Qatari population, but changes in lifestyle and environmental factors cannot be discounted as possible causes of the high prevalence noted in this study.
Bener and Janahi[22]	To investigate the association	n =3500 Qatari schoolchildren	Cross-sectional	A questionnaire was used to collect the	This study revealed a strong association

	between asthma, allergic rhinitis, and eczema in Qatari schoolchildren with allergic conditions in their parents.	aged 6-14 years in the period: February 2003-February 2004	study	clinical history of asthma and allergic rhinitis in their parents and siblings.	between respiratory allergies and eczema in parents and their asthmatic children.
Osundwa and Dawod [23]	To describe the four-year experience with bronchial asthma in a pediatric intensive care unit of Hamad General Hospital in Qatar	n = 47 admissions for life-threatening asthma to the PICU over this period were reviewed	Retrospective chart review	Details of symptoms, medications and outcomes analyzed	This study reported that the mortality for children with life-threatening asthma admitted to PICU is very low if bronchodilators and steroids are used optimally in their management, along with a judicious selection of those requiring mechanical ventilation.
Al Marri [24]	To describe the patterns of the epidemiology of asthma patients who require hospitalization in the state of Qatar.	Discharge data for the year 2002 was reviewed	Cross-sectional analysis	Of these patients, 35% were younger than 15 years, 60% were between 15 and 64 years, and 5% were 65 years or older. The average cost per admission was dollar 1,544.	For asthma patients in Qatar, the hospitalization rate is below the recommended Healthy People 2000 goal and the mortality rate is low.
Dawod <i>et al.</i> [25]	To evaluate acute asthma: treatment and outcome of 2000 consecutive pediatric emergency room visits in Doha, Qatar.	n =1429 males and 571 females with 66.2% < 48 months old. More than 60% of patients had been symptomatic for <24 hr and 88.5% had tried inhaled beta2-agonist before coming to the pediatric emergency room	Cross-sectional study	2000 asthma case files in Hamad Medical Corporation pediatric emergency room (PER) over 2 months.	In the pediatric emergency room, 57% responded to a single salbutamol aerosol and 35.5% responded to a combination of 2-3 salbutamol, IV hydrocortisone, and aminophylline drip < or = 6 hr. Only 7.5% were admitted to the hospital. Of the admitted patients, 82% had been symptomatic for > 24 hr and 60.6% were <4 years old (14
Osundwa <i>et al.</i> [26]	To describe the home nebulizer therapy treatment asthma children over 1 year.	n=50 asthmatic children	Retrospective study	Details of home nebulizer use and need for hospital care measured	We suggest that this form of therapy if properly used in appropriately selected asthmatic children will reduce the need for hospital care
Bener <i>et al.</i> [27]	To investigate the potential role of Vitamin D deficiency in childhood asthma and other allergic	n = 2350 Qatari children below the age of 16 were selected from PHCs, and 1833 agreed to	Cross-sectional study	Face-to-face interviews with parents of all the children were based on a questionnaire that included	The study findings revealed a high prevalence of Vitamin D deficiency in children with asthma and allergic diseases.

	diseases such as allergic rhinitis and wheezing.	participate in this study giving a response rate of (78%).		variables such as socio-demographic information, assessment of nondietary covariates, Vitamin D intake, type of feeding, and laboratory investigations. Their health status was assessed by serum Vitamin D (25-hydroxyvitamin D), family history and body mass index.	Vitamin D deficiency was a strong correlate for asthma, allergic rhinitis and wheezing.
Samer <i>et al.</i> [28]	To cover the current status of asthma and obesity in the Middle East, as well as to introduce the various studies tying the two diseases; further expanding on the proposed mechanisms	NA	Literature review	PubMed and Google Scholar, with no restrictions, using the following terms; asthma, obesity, Middle East, sphingolipids.	This paper covers recent literature related to sphingolipids and its role in asthma, followed by recommendations and future directions

REVIEWED STUDIES

Osundwa and Dawod in 1989 published a case report from Qatar which states that vomiting as a dominant symptom in a patient with acute asthma. The recognized triad of cough, tachypnea and wheezing were absent or trivial whenever this patient presented with persistent vomiting. A careful history, laboratory evaluation and a course of bronchodilators eventually ascertained that the episodes of vomiting were due to attacks of acute asthma. It is suggested that acute asthma be included in the differential diagnosis of recurrent and/or severe vomiting in children [12].

A cross-sectional study conducted by Dawod and Hussain with the aim to study the profile of asthmatic children in Qatar and compare it with other countries, describes the characteristics of asthma in Qatari children which are similar to reports from other developing countries except that patients were younger in age of onset and Bokhour (an Arabian Gulf incense) was an important precipitating factor. Four hundred fourteen outpatient asthmatic children with asthma were reviewed for this study. It consists of detailed clinical questionnaires, physical examinations, and laboratory evaluations. The ages of the patients ranged from 7 months to 12 years. There were 135 girls (32.6%) and 279 boys (67.4%). Seventy per cent of patients had their first episodes within the first 2 years of life. Viral respiratory infections were the most common

precipitating factor (95.17%). Fumes were incriminated as a triggering factor in 36% of patients with Bokhour representing 54% of them. Eighty-six per cent had positive family histories of allergic diseases [13].

Sattar *et al.* conducted a hospital-based prospective study to characterize the most frequent indoor and outdoor respiratory allergens involved in bronchial asthma and allergic rhinitis in the State of Qatar. Age group selected for this study was patients over 12 years of age diagnosed with bronchial asthma and/or allergic rhinitis who were referred for allergy skin pick test. 1106 adult patients were studied, during three years from January 2001 to April 2003. Among the total of 1106 patients, 607 were females (54.9%) and 499 were males (45.1%) and their mean age was 30 years (12-48). Skin Prick Test [SPT] was performed on 1106 patients for common allergens. Blood samples were taken for measuring specific IgE concentration. And the results show that the frequency of indoor and outdoor allergens in the state of Qatar is as a result of the dominance of house dust mites, pollen, grasses etc which are like other countries with similar or even with a different climate. Reduced exposure to these agents will help in controlling the severity of these diseases [14].

A hospital-based prospective descriptive study conducted by Bener *et al.* to determine whether exposure to pets and domestic animals plays a

significant role in the development of asthma and allergic rhinitis among Qatari population concludes that the prevalence of asthma, rhinitis, and skin allergy was significantly more common in families with animals than in those without. This is a part of the above-mentioned study conducted in the Allergy Laboratory at the Hamad General Hospital and Hamad Medical Corporation, State of Qatar. In addition to the Skin Prick Test (SPT) and total IgE concentration measurement, investigators also collected the information of pets in the home of the patients. Three hundred and forty (340/1106=30.7%) of the 1006 subjects studied had at least one animal at home, and the remaining 69.3% never had pets at home. A further 12% reported having had pets in the past, but not anymore [15].

A cross-sectional survey conducted by Bener *et al.* with the purpose to assess the relationship between breastfeeding and the development of childhood asthma and allergic diseases in Qatari children at age 0-5 years. And to investigate the effect of prolonged breastfeeding on the allergic diseases in a developing country, in the Well-baby clinics and Pediatric clinics in the 11 Primary Health Care Centers and Hamad General Hospital, State of Qatar, using a multistage sampling design collected data of 1500 Qatari infants and pre-school children. Out of the 1500 mothers of children, 1278 mothers agreed to participate in this study with the response rate of 85.2%. A confidential, anonymous questionnaire was completed by the selected subjects assessing breastfeeding and allergic diseases. More than half of the infants (59.3%) were exclusively breastfed, followed by infants with partial breastfeeding (28.3%) and formula milk (12.4%). There was a significant difference found across these three categories of infants in terms of their age groups, smoking status of the father, socio-economic status and parental consanguinity. Asthma (15.6%), wheezing (12.7%), allergic rhinitis (22.6%), and eczema (19.4%) were less frequent in exclusively breastfed children, compared to infants with partial breastfeeding and formula milk. The main factors associated with breastfeeding for allergic diseases were being the first baby, maternal history of asthma, and parental history of allergic rhinitis. The study findings open a big avenue for the interventional role of breastfeeding. Therefore, we recommend breastfeeding is as one possible way to reduce the risk of the onset of asthma and allergic diseases in developing countries [16].

The same group of investigators included one more objective in their study and found that the length of breastfeeding was associated with maternal age. Prevalence of eczema (19.4%), allergic rhinitis (22.6%), and wheezing (12.7%) were significantly less frequent in those with prolonged (>6 months) breastfeeding, compared with short-term fed infants. The association between EBF and eczema tended to be similar in

children with a positive family history of atopy ($p < 0.001$) and eczema ($p < 0.001$) compared with those without [17].

A case-control study by Bener *et al.* conducted to determine the effect of polluted environment in increasing the risk of asthma and allergic diseases among school children, provides some evidence that exposure to outdoor air pollutants increases the risk of childhood asthma and allergic diseases in schoolchildren. The results are consistent with the hypothesis that long-term exposure to nitrous oxide and carbon monoxide levels suggests that emissions from photochemical air pollution and oil refinery contribute to adverse health effects in Qatar. The study was carried out among school children living and attending the school in an industrial and residential area during October 2004 and June 2005. The study based on age, sex, and ethnicity of 716 cases (with asthma) and 716 controls (without asthma) among school children living in both urban and in an industrially polluted environment with an oil refinery and chemical pollutant. The International study of asthma and allergies in childhood (ISAAC) and some additional questionnaires were used to collect the data of the school children. The questionnaire included information about: socio-demographic characteristics; respiratory symptoms; associated respiratory illness; family history of allergic diseases among first-degree relatives of asthmatic children; behavioural factors which could be additive to asthma. Univariate and multivariate statistical analyses were performed [18].

Another cross-sectional study was conducted by Bener *et al.* to investigate the genetic and environmental risk factors associated with asthma among Qatari school children aged 6-12 years. In this study, the International study of asthma and allergies in childhood (ISAAC) and some additional questionnaires were used to collect the data of the school children from Feb 2003 to Feb 2004. The multistage sampling design was used and a representative sample of 3500 children was targeted for this study. Of these, 3204 parents (91.6%) of the children agreed to participate in this study. This study revealed that the family history of asthma contributed more to childhood asthma than indoor and outdoor environmental factors. Boys were found more asthmatic than girls. The results of this study support the hypothesis that asthma is a multi-factorial disease related to both familial and environmental influences [19].

Other cross-sectional population-based study, conducted by Bener *et al.* to determine the impact of asthma and air pollution on school attendance of primary school children 6 to 12 years of age in Qatar, utilized the data of total 31,400 Qatari school children at the primary school (16,130 boys and 15,270 girls), 6 to 12 years of age, to investigate school absenteeism caused by asthma and wheezing during the academic

year October 2003 to July 2004. A modified version of the International Study of Asthma and Allergies in Childhood [ISAAC] questionnaire was used, and the study results showed that children with known asthma miss more days of school than those who do not have asthma. This study finding shows that air pollution has an impact on asthma, which results in significant school absenteeism [20].

A cross-sectional study of 3,283 school children living in both urban and rural areas (average age, 9.03 +/- 1.99 years; 52.3% boys and 47.7% girls) was conducted from February 2003-February 2004 by Janahi *et al.* The aim of this study was to determine the prevalence of asthma and allergic diseases among schoolchildren aged 6-14 years in the State of Qatar, based on a questionnaire designed by the International Study of Asthma and Allergy in Childhood (ISAAC). This study showed that the prevalence rate of asthma (19.8%) in Qatari schoolchildren is very close to that in the neighbouring Gulf country, Oman (20.7%), and higher than in some developing countries. Genetic factors related to the high rates of consanguinity may play an important role in the high prevalence rates noted in the Qatari population, but changes in lifestyle and environmental factors cannot be discounted as possible causes of the high prevalence noted in this study [21].

A cross-sectional study by Bener and Janahi was conducted among 3500 Qatari schoolchildren aged 6-14 years in the period: February 2003-February 2004. A questionnaire was used to collect the clinical history of asthma and allergic rhinitis in their parents and siblings. The study aimed to investigate the association between asthma, allergic rhinitis, and eczema in Qatari schoolchildren with allergic conditions in their parents. A questionnaire was used to collect the clinical history of asthma and allergic rhinitis in their parents and siblings. It was found that there is a strong association between respiratory allergies and eczema in parents, and their asthmatic children [22].

In a retrospective chart review Osundwa and, Dawod states that they reviewed charts of all children with severe acute asthma admitted to the Pediatric Intensive Care Unit (PICU) of Hamad General Hospital in Qatar between January 1987 and December 1990. There were 47 admissions for life-threatening asthma to the PICU over this period, representing about 2% of all acute asthma admissions to our hospital. The mean duration of symptoms in these patients before admission was 54 hours. Only 55% of the PICU admissions had received bronchodilators before coming to hospital emergency room from where they were admitted. From arterial blood gas analysis, 57% of the patients had hypercapnia (PaCO₂ > 45 mmHg). All the patients received nebulized salbutamol frequently as well as intravenous aminophylline and hydrocortisone. Mechanical ventilation was used in only 8.5% of the

patients. Only two patients developed a pneumothorax, neither of whom had been mechanically ventilated, but they did not require surgical intervention for drainage. There was only one death in a patient who was known to have sickle cell anaemia and developed sagittal sinus thrombosis. This study concluded that the mortality for children with life-threatening asthma admitted to PICU is very low if bronchodilators and steroids are used optimally in their management, along with a judicious selection of those requiring mechanical ventilation [23].

AlMarri conducted a cross-sectional study to describe the patterns of the epidemiology of asthma patients who require hospitalization in the state of Qatar in 2006. He found that the asthma hospitalization rate was 42 per 100,000 populations. The male-female ratio was 47:53. Of these patients, 35% were younger than 15 years, 60% were between 15 and 64 years, and 5% were 65 years or older. The average cost per admission was US dollar 1,544. The mean length of stay was 6.4 days and was longer for females, Qatar nationals, older patients, and those with comorbid conditions. Infectious diseases were common in younger patients, whereas cardiovascular diseases and diabetes were the most common comorbidities in middle-age and elderly asthmatic patients. December was the peak month for hospitalization. The mortality rate was 1.7 per 100,000 populations. For asthma patients in Qatar, the hospitalization rate is below the recommended Healthy People 2000 goal and the mortality rate is low [24].

Dawod *et al.* conducted a cross-sectional study and seen 2000 asthma case files in Hamad Medical Corporation pediatric emergency room (PER) over 2 months. Patients included 1429 males and 571 females with 66.2% < 48 months old. More than 60% of patients had been symptomatic for <24 hr and 88.5% had tried inhaled beta₂-agonist before coming to the PER. In the PER, 57% responded to a single salbutamol aerosol and 35.5% responded to a combination of 2-3 salbutamol, IV hydrocortisone, and aminophylline drip < or = 6 hr. Only 7.5% were admitted to the hospital. Of the admitted patients, 82% had been symptomatic for > 24 hr and 60.6% were <4 years old [25].

Osundwa *et al.* reviewed charts of 50 asthmatic children who were on home nebulizer therapy for the treatment of their asthma over 1 year. Patients served as their controls for comparison of the asthma-related variables between periods of 6 months before and 6 months after the initiation of home nebulizer treatment. There was a 74% and 70% reduction in the emergency room visits and hospitalizations, respectively, during the period when the patients were on home nebulizer therapy. We suggest that this form of therapy if properly used in appropriately selected asthmatic children will reduce the need for hospital care [26].

Bener *et al.* conducted a cross-sectional study in Primary Health Care Centers (PHCs) of Qatar, from March 2012 to October 2013. The objective of this study was to investigate the potential role of Vitamin D deficiency in childhood asthma and other allergic diseases such as allergic rhinitis and wheezing. A total of 2350 Qatari children below the age of 16 were selected from PHCs, and 1833 agreed to participate in this study giving a response rate of (78%). Face-to-face interviews with parents of all the children were based on a questionnaire that included variables such as socio-demographic information, assessment of nondietary covariates, Vitamin D intake, type of feeding, and laboratory investigations. Their health status was assessed by serum Vitamin D (25-hydroxyvitamin D), family history and body mass index. This study results exposed that most of the children who had asthma (38.5%), allergic rhinitis (34.8%) and wheezing (35.7%) were below 5 years. Consanguinity was significantly higher in parents of children with allergic rhinitis (48.6%), followed by those with asthma (46.4%) and wheezing (40.8%) than in healthy children (35.9%) ($P < 0.001$). The proportion of severe Vitamin D deficiency was significantly higher in children with wheezing (23.4%), allergic rhinitis (18.5%), and asthma (17%) than in healthy children (10.5%). The study findings revealed a high prevalence of Vitamin D deficiency in children with asthma and allergic diseases. Vitamin D deficiency was a strong correlate for asthma, allergic rhinitis and wheezing [27].

Samer *et al.* in their study that aims to cover the current status of asthma and obesity in the Middle East, as well as to introduce the various studies tying the two diseases; further expanding on the proposed mechanisms. Retrieved, the paper covers recent literature related to sphingolipids and its role in asthma, followed by recommendations and future directions. In preparation of this paper, they searched PubMed and Google Scholar, with no restrictions, using the following terms; asthma, obesity, Middle East, sphingolipids. Investigators also used the reference list of retrieved articles to further expand on the pool of articles that were used for this review [28].

DISCUSSION

A total of seventeen studies on childhood asthma were retrieved and reviewed. Except for four studies, most of the studies are from secondary and tertiary care settings. All these studies were conducted in various fields of childhood asthma. Among these seventeen studies, twelve of them are cross-sectional studies, two are hospital-based prospective studies, one is case-control, one is a literature review and one is a case report. Investigators started publication on this topic since 1989, it was a case report and in that, they have presented an acute asthma case with vomiting as a dominant symptom without any traditionally recognized symptoms [12].

Two hospital-based prospective studies discussed sensitizing agents in patients with asthma. One study found that indoor and outdoor allergens like house dust mites, pollen and grasses are very important sensitizing agents in patients with asthma which are more or less same to other countries with similar and even with different climate [14]. And the 2nd study discussed the ownership of the pet and how pets act as a sensitizing agent in patients with asthma. Minimal exposure to these agents will help control raising the severity of asthma [13, 14].

Among the twelve cross-sectional studies, three studies were prevalence studies. These studies revealed that the prevalence of three disorders named asthma, eczema and allergic rhinitis was higher in Qatar, probably similar to Qatar's neighbouring countries. The prevalence rate was significantly higher in males than females and also noted that with increased age the prevalence of asthma and allergic rhinitis was decreasing. The high prevalence rate of asthma and related disorders are mainly because of the high consanguinity rate in Qatar (54%). Environmental factors, pollutants and respiratory viral infections are also playing an important role. The State of Qatar, like many other developed countries, has witnessed a rapid transition in its socioeconomic status. People in Qatar now enjoy a high standard of sedentary fast-food lifestyle like other developed countries. As a result, there have been increases in diseases and serious health problems. These studies also found that children with known asthma miss more days of school than those who do not have asthma [13, 20, 21].

Two studies have investigated the genetics and environmental factors and their association with childhood asthma. Results of these studies shown that asthma is a multi-factorial disease related to both familial and environmental factors and a strong association between allergic parents and their children [18, 19].

Two studies described the role and duration of exclusive breastfeeding in the prevention of asthma and allergic diseases in Qatari children. Both study results have shown that exclusive breastfeeding can prevent the risk of asthma and allergic diseases [16, 17].

Four studies described the medications and hospitalization for acute asthmatics in Qatar. Appropriate use of home nebulizer therapy can reduce the hospital admissions of asthmatic children. Compared to other countries, the asthma mortality rate is low in Qatar by recommended healthy people 2000 goal [23-26].

Remaining one cross-sectional study is about the impact of vitamin D deficiency on, asthma, allergic rhinitis and wheezing in children. Vitamin D deficiency was a strong correlate for asthma, allergic rhinitis and

wheezing in children. Qatar has a high prevalence of vitamin D deficiency in asthmatic children [27].

The case-control study provides evidence that exposure to outdoor air pollutants like Nitrous oxide and Carbon monoxide emissions from photochemical air pollution and oil refinery contributes to adverse health problems in Qatar including childhood asthma and related allergic diseases [8].

Last publication on asthma in childhood was a literature review report and in this study, investigators try to expose the status of asthma and obesity in the Middle East Countries [28].

We haven't described about the limitations of the retrieved studies due to lack of full paper availability on the internet, and this is a limitation for our study as well.

CONCLUSION

This review of the literature revealed that the diagnosed prevalence of asthma among Qatari school children maybe 19.8 %. The combination of genetic, environmental, and socioeconomic factors might explain the noted high prevalence rates of asthma and related disorders. The population of Qatar is growing day by day, of whom 30% are Qatari nationals. The consanguinity rate is very high (54%) in the Qatari population, that may also lead to the marked genetic influences than elsewhere. So far there has been no survey which describes the prevalence of asthma and allergic diseases in the Qatar population. Further, well-designed studies, need to analyze the high prevalence rates and factors affecting childhood asthma in Qatar. Strategies which result in well-controlled asthma are associated with a significant reduction in economic burden compared to uncontrolled diseases. Qatar and most countries have not yet estimated the economic burden of asthma. Where it has been estimated, the economic burden of asthma is great because of direct healthcare costs, and indirect costs, as a result of the loss of productivity due to people being absent from work, or working less effectively while at work. The impact of these indirect costs would be diminished by improving asthma control, through improving access to good management including medicines. We hope this study also help organizational leaders to start thinking about the importance of clinical control measures to reduce the burden of asthma in children in Qatar.

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