

Research Article

Asthma Management in Qatar: Environmental Challenges and Recommendations

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Abstract

Asthma has become the most common respiratory problem in the world. A number of environmental factors that trigger asthma have been cited. These include indoor and outdoor pollutants, allergens, and infections. In Qatar, however, poor air quality seems to be the most common trigger of asthma. With the second highest prevalence of childhood asthma in the Gulf region (19.8%), the factors that contribute to this poor air quality include natural sources, microbial communities, phytoplankton blooms, anthropogenic sources, vehicular emissions, industrial emissions, and construction activity. With the increasing changes to the climate and the ongoing development of the

country, Qatar is facing a growing problem. As such, investigation into the air quality is required. In addition, the development of national asthma control guidelines and education and training programs is essential in order to combat this growing issue and lower the prevalence of asthma in the country.

Keywords: Asthma; Qatar; Asthma management; Environmental factors

Abbreviations

COPD= chronic obstructive pulmonary disease

GCC= Gulf Cooperation Council

SINA= Saudi Initiative for Asthma

1. Background

Studies have highlighted the increase in number of chronic respiratory disorder cases (Bousquet, Bousquet, Godard, and Daures [1]). As the most common respiratory disorder, affecting 339 million people and causing more than 400,000 deaths worldwide in 2016 alone (WHO [2]); asthma is no exception to the trend. Asthma has become an ever-increasing problem in today's world, with data suggesting a global surge in asthma prevalence with no apparent decline (Pearce et al., [3]). A review by Bousquet highlighted the high burden of asthma in relation to its morbidity and mortality across the globe (Bousquet et al., [1]). This has been attributed to several factors, among those are poor adherence to asthma control guidelines and, lack of education and training programs (Al-Busaidi et al., [4]; Alreshidi [5]; Anwar et al., [6]; Benkheder et al., [7]; Foggs, [8]; Haouichat et al., [9]; Ibrahim et al., [10]).

Asthma, which usually manifests in childhood, is caused by prolonged inflammation of the airway passage, resulting in its tightening and obstruction. This, in turn, leads to the episodic occurrence of symptoms which include wheezing, dyspnea, tightening of the chest, and coughing (Bai and Knight [11]; Strachan [12]; WHO [13]). Investigation into the factors that influence the etiology and pathogenesis of asthma are not only essential for a better understanding of the disease, but also for the development of measures to control it (Al-Rawas et al., [14]). Numerous studies have linked environmental factors with either the development and or the severity of asthma (Cockcroft [15]; Diette et al., [16]; Nunes et al., [17]). Yet, it has been suggested that environmental factors alone may not be responsible for the expression of the disease, but

rather it is a result of an interaction between both genetic and environmental factors (Alreshidi [5]; Alsharairi [18]; Foggs [8]). However, the genetic factors are not as well researched as the environmental factors.

As urbanization and the adaptation of a modern lifestyle increases, so does the prevalence of asthma (Bousquet et al., [1]), therefore, developed areas have a higher prevalence of asthma (Song and Wong [19]). However, in some developing countries, where increases in urbanization have taken place, an increase in the prevalence of asthma has also been seen (Ellwood et al., [20]). It can be argued that the developments that come hand in hand with urbanization may be linked to the increase in the prevalence of asthma. Specifically, in Qatar, the rapid development of the country, which includes but is not limited to, vehicular and ship emissions, and emissions from industrial undertakings, have led to poor air quality.

With reduced air quality comes a rise in health issues (Teather et al., [21]). Scientists have indicated that this high level increases the chances of developing respiratory diseases such as chronic obstructive pulmonary disease (COPD) or asthma (Charfeddine et al., [22]). In Qatar, air quality has been negatively impacted lately due to a variety of reasons such as natural sources, microbial communities, phytoplankton blooms, anthropogenic sources, vehicular emissions, industrial emissions, and construction activity (Teather et al., [21]).

Poor air quality in turn reflects on several aspects as related to the population in Qatar including absenteeism from school, as shown in one study that

was conducted on more than 30,000 school children and found that 10% had asthma and wheezing. Additionally, these were found to have lower attendance when compared to those without asthma (Bener et al., [23]). Another cross-sectional asthma study showed a high rate of absenteeism (26%) among the 520 adult participants during a 3-month period (Foggs [8]).

2. Environmental Factors

Several studies suggest environmental determinants in the causation of asthma (Basagaña et al., [24]; Lin et al., [25]; Thorn et al., [26]). Exposure to many environmental factors can provoke and exacerbate attacks of asthma among individuals who already have the disease (Dick et al., [27]). They act as stimuli which elicit acute airway narrowing in an individual with increased airway hyper responsiveness. Environmental triggers of asthma include indoor and outdoor pollutants, allergens, and infections (Diette et al., [16]). Constant exposure to these indoor and outdoor triggers can lead to immune dysfunction and impaired tolerance in humans. However, since now a days, particularly in industrialized countries, individuals spend most of their time indoor, triggers in the indoor environment have received more attention (Diette et al., [16]; Schwab et al., [28]; Strachan [12]).

In addition, studies have shown that concentrations of indoor pollutants are far greater than that of outdoor pollutants (Diette et al., [29]). While the association between asthma and indoor air pollutants is not that well established, the existing research does imply that they may play a crucial part in asthma morbidity (Diette et al., [16]).

Among the indoor environmental triggers of asthma that were identified in several epidemiological and experimental studies are molds, dust mites, damp housing, air conditioning, second hand smoke, cockroaches, animal dander and allergens (furred pets or feathered animals), chemical fumes of cleaning products and building materials, combustion products of fireplaces, furnaces, stoves, and kerosene or gas heaters (such as carbon dioxide, nitrogen dioxide, sulfur dioxide, and particulate matter), and dietary factors (Dick et al., [27]; Diette et al., [16]; Pawankar et al., [30]).

On the other hand, air pollutants (ozone, carbon dioxide, nitrogen oxide, sulfur dioxide), particulate matter, traffic related pollutants and diesel exhaust, pollens, molds, and some occupational sanitizers and irritants (e.g. aldehydes, cleaning agents, epoxy glues, latex) are considered outdoor risk factors of asthma and respiratory allergic diseases (Dick et al., [27]; Diette et al., [16]; Pawankar et al., [30]). However, it should be noted that outdoor allergens have a seasonal presence and as such only trigger asthma accordingly. Indoor allergens on the other hand usually present all year and, as such, elicit perennial symptoms of asthma (Diette et al., [16]).

3. Asia

The fast pace urbanization, rapid economic development, increasing industrialization and infrastructure, and reduced green space that are existing globally come with deleterious environmental effects such as climate change and air pollution. These environmental problems have detrimental effects on respiratory diseases like asthma and are causing substantial increase in the burden of asthma. In Asia, asthma is now the most common chronic

disease (Song and Wong [19]). A white paper published recently by Asia Pacific Association Allergy, Asthma and Clinical Immunology highlighted the major components of outdoor and indoor air pollutants and their implications on the epidemic rise of asthma and allergic diseases in the Asia Pacific region. The climate change in this region is associated with increasing concentration of CO₂ in the atmosphere, poor air quality and increasing concentrations of emitted O₃. The increased atmospheric concentrations of CO₂ increase allergen amount in the air as it stimulates pollen production and allows the emergence of new pollen species that are not endemic to the area. Whereas, O₃ worsen the disease manifestations in susceptible individuals as it increases permeability of the mucus membranes and thus allows easier penetration of allergens and interaction with immune cells (D'Amato et al., [31]). The global burden of O₃ on asthma emergency room visits is estimated to be 9-25 million (Anenberg et al., [32]). Other air pollutants include SO₂ and nitrous, which are released in the atmosphere due to burning of fossil fuel and transportation, and particulate matter with a diameter of 2.5 micrometer or less such as dust and sea salt.

4. Gulf Region (GCC)

In the GCC region, asthma has become the most common respiratory disease that results in hospital admission, specifically in children with the prevalence across the region being as follows: Oman 20%, Qatar 19.8%, Saudi Arabia 19.6%, Kuwait 16.8%, and UAE 13% (Al Ghobain et al., [33]; Al-Riyami et al., [34]; Behbehani et al., [35]; Janahi et al., [36, 37]; Lestringant et al., [38]). A study from Saudi Arabia reported on local asthma triggers which included a list of internal and external environmental factors such as

chemical, occupational hazards, and smoking among others. The study concluded that these ecological and demographic factors may cause Saudi children to be affected by asthma at higher rates than their counterparts (Alreshidi, [5]). While another study found that 2 million Saudis are affected by asthma and that this prevalence is due to changes in lifestyle, allergens, tobacco smoke, sandstorms, air pollutants and socioeconomic status (Hussain et al., [39]). A research study conducted in Kuwait has found that dust storms, which occur there for 18% of the year, were linked to asthma and respiratory hospital admissions (Draxler et al., [40]; Thalib and Al-Taiar [41]). A study from Oman showed that bakhour triggers wheezing in asthmatic children (Al-Rawas et al., [14]). Since bakhour is very common in the culture of Gulf countries, it is expected that the same effects may be seen in most regions in the GCC.

5. Qatar

Locally in Qatar, the prevalence among school children stood at a high 19.8%, while the prevalence among adults was around 9% (Ibrahim et al., [42]; Janahi et al., [36, 37]). A literature review on asthma among children reported that the prevalence among school children is similar to adjacent countries such as in Oman (Veettil et al., [43]). A total of 8.5% of work load at primary care was on asthma according to one study which reported the highest prevalence rates among the age group 5-6 years (10.2%) and the lowest among the age group 10-12 years (4.1%) (Veettil and Alnuaimi [44]).

On the other hand, pollution is considered to be high according to local estimates or reports. The authors of one report indicate that this high level increases the chances of developing respiratory diseases such as

COPD or asthma. The source of air pollution is the greenhouse gas emissions of which Qatar has a high per capita rate, as it ranks first in CO₂ emission per capita (Charfeddine et al., [22]).

A study by Teather and colleagues (2013) examined the factors that contribute to Qatar's poor air quality. Many of the factors were due to the considerable development that Qatar has experienced. One of the first sources mentioned to affect the air quality in Qatar and the other regions of the Middle East were dust/sand particles, which are carried by wind during desert storms. Due to the scarcity of precipitation in the region, these particles remain suspended in the air for long periods of time. Another aspect that is of importance are the microbial communities that are found in the desert soils which disperse during storms and have been found to cause respiratory problems (Kwaasi et al., [45]). It has also been shown that the populations of phytoplankton in the waters surrounding Qatar release volatile organic chemicals which contributes to the country's poor air quality. In addition, due to the country's rapid development anthropogenic sources such as, vehicular emissions, industrial emission, and construction activity have all contributed to the worsening of the air quality (Teather et al., [21]).

Furthermore, the most common precipitating factor in a study which included 414 child, ages 7 months to 12 years was viral respiratory infections (95.17%). Bakhour among other fumes was also implicated as a triggering factor. In fact, it was found that in 19% of children, bakhour use was cited as a causal factor (Dawod and Hussain [46]). Other researchers reported lifestyle, genetics, and environmental factors as possible contributing factors in the diagnosis of asthma among children ages 6-14 years (Janahi et al.,

[36, 37]). Diet has been cited as another trigger of asthma. A cross-sectional study conducted on the consumption of soft drinks among Qatari adults found that individuals who consumed soft drinks more than seven times a week were twice as likely to have asthma compared to individual who did not consume soft drinks (Ibrahim et al., [42]).

In addition, another study found a strong association between obesity and asthma among older children, females, and Qatari nationals (Veettil and Alnuaimi [44]). Bener and colleagues [47] found that a deficiency in vitamin D was a major predictor of asthma in Qatari children and that most asthmatic children had a vitamin D deficiency. A Qatari study was conducted to determine whether exposure to pets influenced the development of asthma. It was found that the prevalence of asthma was more common in households that kept pets than in those that did not (Janahi et al., [36, 37]). Another study that was conducted on participants ages 12 years and above, and reported that house dust mites, grasses and pollen were found in similar fashion to other countries with different climates. The most common allergens detected were: *Dermatophagoides Pteronyssimus* (41.6%), *Dermatophagoides Farinae* (36.9%), and Cockroach allergen (32.2%) (Sattar et al., [48]).

6. Asthma Management

The National Asthma Education and Prevention Program identifies the following factors as part of asthma management: controlling environmental factors, educational efforts, and pharmaceutical management (National Asthma Education and Prevention Program [49]). Other authors have highlighted that controlling both indoor and outdoor environmental exposures is necessary for asthma

management. A systematic review investigating the association between asthma control and environmental factors showed that these factors had a role on exacerbations among children (Dick et al., [27]). For indoor environmental factors control, the author recommend it be tailored to each type of exposure, as it has shown to reduce both symptoms and exacerbations (Matsui et al., [50]). This includes improving ventilation and not smoking indoors. For outdoor factors it is recommended to avoid exposure in the first place (Alreshidi [5]; Diette et al., [16]). Moreover, Among the factors that are shown to be useful in reducing triggers and in turn improvements in their asthma: parental health education, mechanical ventilation, improving cleaning methods, using high efficiency particulate air vacuum cleaners, and dust mite-impermeable bedding covers (Wu and Takaro [51]).

From Asia, one study highlighted that asthma control in its respective countries are considered to be poor in comparison to other global areas. Only 2% of patients in Asia are considered to have reached complete control, while in Europe or Canada the number rises to 16%, and even up to 29% in the United States of America. The study indicated that the various beliefs people of the region hold are the reason behind the lower control figures (Song and Wong [19]). Locally in Qatar, a study which included 520 adult asthmatic patients showed that 33% of the sample had uncontrolled asthma. The study concluded by recommending the implementation of a national asthma improvement program in order to improve control figures in the country (Ibrahim et al., [10]).

As for barriers to management, whether different or overlapping in various regions, all contribute to the

availability or affordability of the implementation of asthma management plans (Bousquet et al., [1]). One systematic review identified the following barriers: education factors, being able to identify symptoms, and health beliefs as related to asthma and its management (Miles et al., [52]). Other barriers were identified in other studies and include: occupational exposures, nutritional factors and indoor and outdoor pollution (Bousquet et al., [1]).

7. Recommendations

Further investigations into the air quality in Qatar is deemed necessary. This can aid in developing strategies that support the improvement of air quality. For an example expanding on the green space in the country (Charfeddine et al., [22]). Establishing educational pamphlets and health related interventions that are focused on the local population is another aspect that requires urgency in implementation (Song and Wong [19]).

Furthermore, a literature review focused on childhood asthma in Qatar emphasized the need for more research focused on children and asthma in order to build the foundation of knowledge on which future policy makers can establish control mechanisms and strategies (Veettil et al., [43]). The usage of preventive asthma strategies was recommended by the authors of a study which covered the visits of children aged 5-12 years to the primary health care centers between 2016 and 2017 in Qatar (Veettil and Alnuaimi [44]).

Recommendations into limiting the prevalence of asthma in Qatar include investigations into the country's poor air quality, an increase in research focused on child asthma in order to establish the

foundation of knowledge on which future policy makers can establish control mechanisms and strategies, and the development of guidelines specific to the country that are based on the recommendations from the National Asthma Education and Prevention Program.

Finally, the recommendations from the National Asthma Education and Prevention Program, provide a list of 10 activities related to quality asthma care and management, involving assessment, education, pharmacotherapy, and control. These need to be the corner stone when developing any management plan (Williams et al., [53]). Additionally, the Saudi Initiative for Asthma (SINA) are guidelines that were developed by the Saudi Thoracic Society and provide customized recommendation to the region (Al-Moamary et al., [54]).

8. Summary

Determining the factors that trigger asthma is essential in preventing and controlling the disease. An array of environmental factors have been listed as triggers of asthma, however it has been suggested that genetics also play a role. Nevertheless, research on the genetic factors are not as well researched as the environmental factors. Research on asthma in the GCC has come up with multiple factors that trigger asthma. One common trigger among the Gulf countries are particulates and microbes found in dust and sand particles dispersed during desert storms.

Bakhour was another precipitating trigger of asthma among most Gulf countries. In Qatar, the effects of urbanization and the adaptation of a modern lifestyle have resulted in poor air quality which has been considered as a major trigger of asthma in the

country. With the increasing changes to the climate and the ongoing development of the country air quality, Qatar is facing a growing problem. As such, investigation into the air quality is required. In addition, the development of national asthma control guidelines and education and training programs is essential in order to combat this growing issue and lower the prevalence of asthma in the country.

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Conflicts of interest

None.

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