

## **The Prevalence of Asthma and its Related Risk Factors among the Children in Hail Area, Kingdom of Saudi Arabia**

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### **Abstract**

**Background:** The prevalence of asthma has increased considerably in the last few years.

**Aims:** The aim of this study was to assess the prevalence of asthma and its related risk factors among children in Hail, Saudi Arabia.

**Materials and Methods:** A cross-sectional prospective study was carried out. Well-designed, pretested and modified questionnaires were distributed during the period from September to November 2017.

**Results:** A total of one hundred children completed the questionnaire with a response rate of 100% among these (63.6%) were male and rest were females. Prevalence of asthma among girls (14.4%) was higher than boys (12.4%), but this was found to be statistically insignificant. Asthma prevalence was significantly higher among Saudi participants (14.4%) as compared to non-Saudi (5.9%). Type of residency and the presence of a plant or pets at home had no significant effect on asthma prevalence. On the other hand, smoking of family member and a history of asthma in the family had a significant association on asthma prevalence rate. The highest prevalence of asthma (29.7%) was found among the younger children (< 3 years). Symptoms of asthma were found to be increased with exercise. A positive correlation between asthma and both cough and breathlessness was evident. While asthma had not affected school attendance, visiting or admission to hospitals. Lastly, the Body mass index had no effect on the prevalence of asthma.

**Conclusion:** The asthma prevalence rate among children was 13.1%, whereas smoking and a history of asthma in the family increased this rate. Future studies are recommended to investigate asthma prevalence based on clinical and laboratory diagnosis to explore the link between asthma and obesity.

**Keywords:** Asthma; Prevalence; Risk Factors; Hail

### **Introduction and Methodology**

Asthma is considered as the most prevalent chronic disease among children. It is characterized by repeated attacks of breathlessness and wheezing. The incidences of asthma has raised considerably in the last few years in many countries. It has been estimated by the World Health Organization that nearly 235 million people suffer from asthma at present, and therefore it places a big burden on health resources in a lot of countries [1].

Asthma is found to be one of the most widely spread chronic disease in Saudi Arabia as approximately 2 million Saudis population suffer from asthma [2]. These are generally under-diagnosed and under-treated which results in a considerable burden on individuals and families and greatly limits individuals' course of actions for the whole life. The prevalence of asthma has greatly increased in the past few years in many countries including the Kingdom of Saudi Arabia (KSA). The consequences of asthma is not just limited to the patients themselves, but also to their families and the society as a whole is also affected. The socioeconomic impact of asthma are calculated in terms of less efficiency at work and school absenteeism, decreased quality of life, repeated visits to clinics, hospital admissions, and could also be fatal [2-5]. Asthma, although being a non-curable chronic disease; has a comparatively low mortality rate than to similar chronic diseases. Research reports from within the Kingdom depicts that the prevalence of asthma is on a rise irrespective of the abundance of good quality health services and the access to worldwide guidelines. For example, a research [6] was done to compare the prevalence rate

of asthma in schoolchildren residing in different areas of the Kingdom (Riyadh vs. Hail, Jeddah vs. Gizan). According to the results of this study the prevalence of bronchial asthma among schoolchildren in the same age group increased considerably from 8% in 1986 to 23% in 1995. Also, they concluded high exposure to environmental causes of asthma (smoking and indoor pets), possibly due to rapid changes in the lifestyle of Saudi population (effects of modernization). Another similar study was done in Al-Khobar city by Al-Dawood [3]. The results stated that prevalence of asthma in schoolchildren was found to be 9.5% (141/1482). A cross-sectional study based on questionnaire was performed using both urban and rural 12-year-old children population. According to the results of the study urban children had significantly higher prevalence of allergic symptoms as compared to rural children, and among Saudi compared to non-Saudi Arab children. Results of the present this study also showed that socioeconomic factor had no effect on the prevalence of asthma. An interesting finding of this study was a rise in the prevalence of allergic disease among Saudi children whereas non-Saudi children were affected [7]. Another study investigated children aged 7 - 12 years for asthma prevalence using a cross-sectional questionnaire-based study in two areas (Dammam vs. Riyadh) of Saudi Arabia in the year 1986 - 1989. Symptoms of wheezing, rhinitis, and eczema were found to be more common among children in Riyadh as compared to their counterparts in Dammam. Asthma prevalence (9.28%) is significantly ( $P < 0.05$ ) more among children in Riyadh when compared to children in Dammam which was only 3.59%. results of this study also concluded that a statistically significant link was present between asthma and breathing difficulty, smoking of parents, presence of pets at home, coughing, and family history of allergy. Another research study compared the prevalence of asthma as diagnosed by physicians among Saudi school children in an industrial city of Yanbu, with two non-industrial populations (Al-Furash and Al-Gafur). The cases of asthma in Yanbu (13.9%) were found to be much more than the rural communities (8%) [8]. Another researcher [9] found that a very little percentage (39%) of primary care health employees meet the standards of the local guidelines in the management of asthma. Furthermore, the general awareness level among physicians was not good (52%). Their skills in overall knowledge, diagnosis, management of severity, and the process of controlling asthma was also poor. The occurrence of asthma and its related impact in 16- to 18-year-old youths (both boys and girls) attending high schools in Riyadh was inquired into using the International Study of Asthma and Allergies in Children questionnaire. This questionnaire-diagnosed asthma calculated the prevalence of lifetime wheeze (25.3%), wheeze during the last 12 months (18.5%), and physician-diagnosed asthma (19.6%). The prevalence rate of wheezing after exercise and coughing during the night in the past one year was 20.2% and 25.7%, respectively [10]. The accurate prevalence of asthma in Saudi Adults is unknown; but another investigator [4] conducted a 5-year research which assess the records of hospitalized adult patients with respiratory problems at the King Abdulaziz University Hospital (Jeddah, KSA) from 1996 to 2000. This study disclosed that bronchial asthma (38.6%) was the most commonly found respiratory disease among the age group 46 - 65 years [4]. The prevalence rate of asthma among Saudi children was outlined to be from 8% to 25%, the highest percentage (25%) of physician-diagnosed asthma in Saudi Arabia was reported by researchers in 2004 [11]. In conclusion, epidemiological studies in Saudi Arabia revealed that the prevalence of asthma is on an increase during the past three decades, may be because of the fast changing lifestyle linked to the modernization of Saudi community, urbanization in food habits, and growing exposure to environmental causes of asthma such as pets and plants. Moreover, the rise in asthma cases could be explained in terms of an increased knowledge and perception of the disease among the general population and healthcare team. As a result more and more individuals are being diagnosed with asthma.

It is quite obvious that from previously mentioned researches, there is a limited research in the scientific literature about the prevalence of asthma in the Hail area. This study focused on assessing the relation between asthma and its correlated risk factors among children in Hail City, and to compare these results and associate them with the gender of participants, a variety of environmental causes of asthma (e.g. indoor allergen, outdoor allergen, tobacco smoke, and air pollution), and genetic factors as well. It inquired into the relation between asthma, and the use and suitability of prophylactic drugs, visiting to a family physician, hospitalization, and the episodes of asthma. At last, it compared asthma prevalence among the population in different regions of the Hail city.

## Results and Discussion

Parents of 100 children gave their consent and have completed the questionnaires with response rate (100%), (63%) out of the participants were male. Asthma prevalence rate among girls (14.4%) was higher than boys (12.4%) but this was statistically insignificant ( $P > 0.05$ ) (Table 1). Average asthma prevalence rate (13.4%) among children in Hail was higher than that found in Riyadh (9.28%) and Dammam (3.59%) [5]. On contrast, asthma prevalence of the present study was within the national range (8 - 23%) in the Kingdom [6]. It was also in accordance with those of other researchers [13] who found that the prevalence of asthma in Yanbu, Saudi Arabia was 13.9%.

Majority of participants (86%) were Saudi, while only 12 were non-Saudi (Table 1). Asthma rate was significantly ( $P < 0.05$ ) higher among Saudi children (14%) than non-Saudi (6%) (Table 1). Our results were in accordance with those of Bener, et al. [8] who found higher rate of allergic disease among Saudi children than non-Saudi. The difference in asthma rate among Saudi and non-Saudi children live in the same urban was interesting. The exact nationality of each non-Saudi child was not included in the questionnaire. It would be difficult to explain the low rate of asthma among non-Saudi children. Therefore, further studies should be conducted to investigate differences in asthma rate between these two groups living in Hail region.

Demographic characteristics	Frequency (%age)	Asthma Yes	Asthma No	P value
<b>Gender</b>				
Male	64	12	88	0.234
Female	36	14	86	
<b>Nationality</b>				
Saudi	86	14	86	0.001
Non-Saudi	14	6	94	
<b>Age (years)</b>				
< 3	4	30	70	0.001
3 - 6	3	29	71	
7 - 12	56	13	87	
13 - 18	37	11	89	
<b>Residency</b>				
City	96	12	88	0.357
Village	4	17	83	

Table 1: Demographic characteristics of the participants.

The majority of participants (96%) live in Hail city while only 4% live in rural areas around Hail (Table 1). However, the rate of asthma was higher in rural areas (17%) than urban areas (12%) but this difference was insignificant ( $P > 0.05$ ). Theoretically, asthma rate should be higher in children in an urban environment than rural areas, possibly due to increased aeroallergen (indoor and outdoor). Results of the present study were contrary to other studies [3,8]. For example, Bener, *et al.* [8] found that physician-diagnosed asthma rate in the industrial city of Yanbu (13.9%) was higher than the corresponding rate (8%) in two non-industrial villages.

Furthermore, the presence of a plant at home had no significant effect ( $P = 0.907$ ) on the prevalence of asthma (Table 2). Although 17% of asthmatic participant mentioned that they have pets at home compared to 13% of asthmatic children that they do not have them, this factor seemed to have no considerable ( $P = 0.132$ ) impact on asthma rate. Our results were inconsistent with those of Al-Dawood [3] who found a positive link between asthma and presence of pets at homes of school boys in Al-Khobar city, KSA. A similar association was reported by Al Frayh., *et al* [6].

Risk factor	Asthma (Yes)	Asthma (No)	P value
<b>Plants present</b>			
Yes	13	87	0.907
No	14	86	
<b>Presence of pets</b>			
Yes	17	83	0.132
No	13	77	
<b>Living near industrial zone</b>			
Yes	12	88	0.52
No	14	86	
<b>Smoking of family member</b>			
Yes	39	61	0.001
No	8	92	
<b>Asthma in parents</b>			
Yes	17	83	0.003
No	12	88	
<b>Body Mass index</b>			
Underweight	14	86	> 0.05
Normal	6	94	
Overweight	14	86	
Obese	10	90	

Table 2: The relation between prevalence of asthma and different risk factors.

Smoking of a family member has a significant ( $P < 0.001$ ) positive impact on asthma prevalence rate among asthmatic children (39.0%) compared to non-asthmatic (8%) (Table 2). This finding clearly indicated that increase exposure to tobacco enhances prevalence of asthma through irritating inflamed bronchial airways. The positive association between smoking tobacco and asthma of this study is consistent with several research works that conducted in KSA and also worldwide [3,5,6,13]. For example, some researchers [6] found that 17% of asthmatic children had at least one or more family members were cigarettes smoker.

Age of participations was divided into four categories:  $< 3$ , 3 - 6, 7 - 12 and 13 - 18. The highest prevalence of asthma (30%) was reported among the younger children ( $< 3$  years), followed by the group aged 3 - 6 years (29%), the lowest prevalence (11%) was reported for children aged 13 - 18 years (Table 1). Results revealed that prevalence of asthma is decreasing significantly ( $P = 0.001$ ) as the children getting older, possibly airways could develop some kind of protection with advancing age. Our results agreed with those of Al Frayh., *et al.* [6] who found that asthma rate decreases as age increases. There was a significant ( $P = 0.003$ ) association between asthma prevalence rate and genetics, as 17% of asthmatic children have their parents suffer from bronchial asthma while only 12% of non-asthmatic children have normal (no signs of asthma) parents (Table 2).

Results of this study indicated that body mass index (BMI) had no significant effect ( $P > 0.05$ ) on asthma (Table 2). Furthermore, further statistical analysis confirmed such a result as 95% CIs were insignificant. This finding regarding the relationship between BMI and asthma was against expectation. The lungs of obese people are under expanded, and the size of breath is smaller than normal non-obese persons. Also, obese persons have low-grade systemic inflammation that stemmed from inflammation of fat tissues. Therefore, these factors may cause narrowing of lung airways. Another biochemical effect of obesity is variations in the level of serum leptin. These unexpected results should be thoroughly investigated in future. Pulmonary function test (screening for lung capacity), allergy skin pick test, plasma total IgE levels, blood eosinophil counts, and serum leptin levels should be examined, and compared among asthmatic and non-asthmatic obese children.

Figure 1 showed the percent of asthma symptoms among asthmatic children in Hail city. Results revealed that cough was the most frequent occurred symptoms (34%) among asthmatic children. Difficulties in breathing were ranked the second common symptom (21%) while the wheezing prevalence was the least frequent occurred symptom (3%). The results presented in this study showed a significant positive association between prevalence of asthma and both cough and breathlessness. Bener, *et al.* [8] found that the frequency of cough, breathlessness, and wheezing among children in Riyadh was 7.9%, 12.13%, and 11.86%, respectively. Furthermore, these symptoms were occurring more frequently in Riyadh (dry-inland) compared to Dammam (humid-coastal).

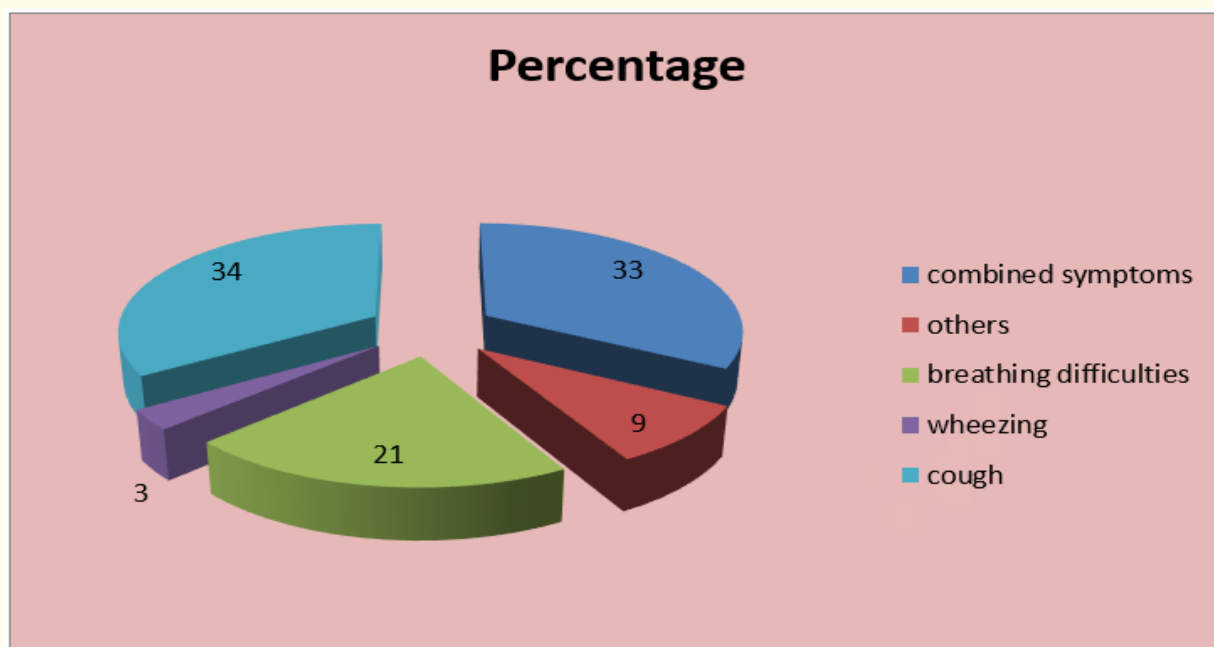


Figure 1: Symptoms of asthma among asthmatic children.

Figure 2 showed that 59% of participants used inhalation bronchodilator for the treatment of asthma while 20.0% of asthmatic children used syrup. One interesting finding of this study was the time of diagnosis of asthma. About half (48%) of children suffer from asthma symptoms were diagnosed less than 1 year from the start of the present study (Figure 3).

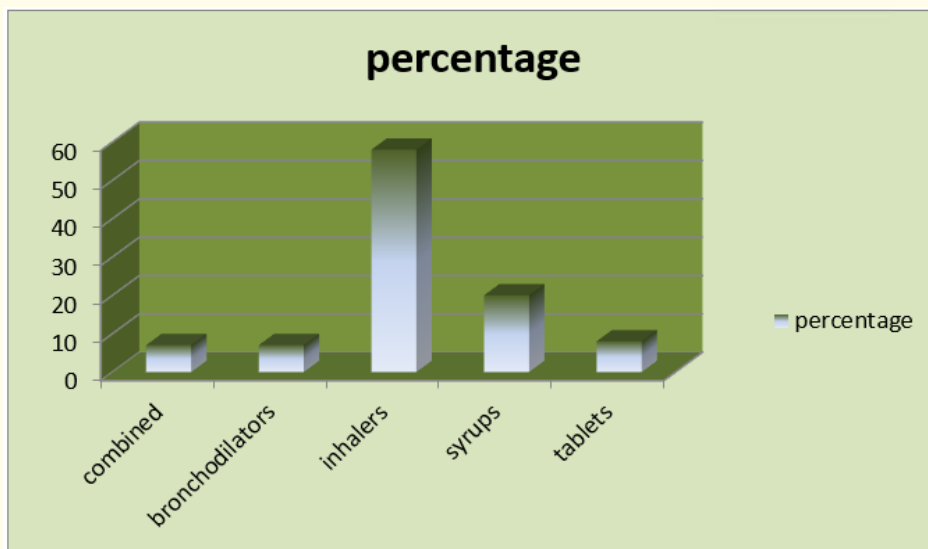


Figure 2: Type of treatment of asthmatic children.

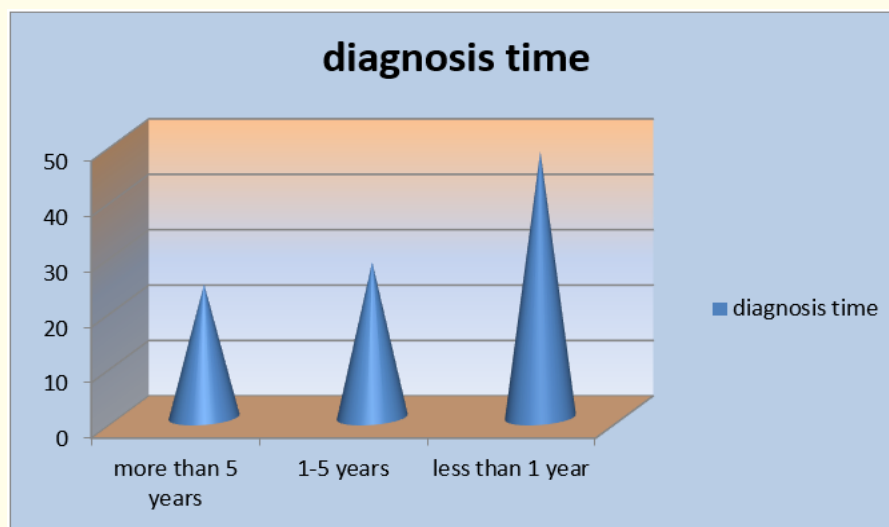


Figure 3: Diagnosis time of asthma among participated asthmatic children.

When the parents have been asked about frequency of their children suffer from asthma symptoms in the past 6 months. One-third of the respondents (33%) indicated that their asthmatic children had asthma symptoms once per season. While 25% of children mentioned that, their children did not experience asthma in the last 6 months. Asthmatic children that experienced symptoms more frequently were (once per month) only 16% (Table 3).

The majority of asthmatic participants (53%) (data not shown) experienced symptoms during exercise, while (47%) (data not shown) of children did not have exercise-induced asthma symptoms. Al-Moamary, *et al.* [2] found that exercise-stimulated wheeze (57.4%) in school children in Riyadh. Matsumoto, *et al.* [13] found that a 6-week swimming program has a protective role against exercise-triggered asthma. Exercise stimulated asthma could be due to a change in osmolarity of the lining fluid of the airways, possibly due heat and water

loss to the inspired air [13]. However, the exact mechanism is still not fully understood, and thus, further studies should be carried out to investigate such mechanism.

Signs	Frequencies							
Suffering from asthma symptoms	Never	1/week	1/2 weeks	1/month	1/2 months	1/3 months	1/6 months	1/season
	25%	7%	3%	16%	4%	5%	6%	34%
Sleeping difficulties	Never	Daily	< 2/week	>2/week	2/month	> 2/month		
	56%	6%	4%	3%	24%	7%		
<b>Effects</b>								
Visit family doctors	1/week	1/2 weeks	1/month	1/2 months	1/3 months	1/6 months	1/season	
	4%	6%	14%	7%	11%	7%	51%	
Absent from school	Never	1/month	1/2 weeks	1 or more/ week				
	56%	19%	11%	14%				
Admission to hospital	Never	1/last 6 months	2 or more in last 6 months					
	73%	18%	9%					

Table 3: Signs of asthma and its effects on children.

Most of the asthmatic children participating in this study visited a family doctor once per season (51%) in the last 6 months, while 14.0% of children have seen their doctor once per month, and 11% have mentioned that they visited their doctors once per 3 months (Table 3). Al-Dawood [3] found that 65.2% of children in Al-Khobar city have visited a hospital emergency services in the present academic year compared to 34.8% of asthmatic school boys have used such services.

Table 3 showed that the majority of asthmatic children (56%) did not experience difficulties in sleeping due to asthma during the last 6 months, where 24% of children with asthma had difficulties in sleeping.

Regarding the effects of asthma on school absenteeism, 56% of participated asthmatic children did not absent from their schools in the past academic year, while the remaining (44%) were absent from school at varying levels. Al-Dawood [3] reported that the mean period of school absenteeism (13.6 ± 3.4) in an academic year among asthmatic schoolchildren in Al-Khobar city (KSA). In the same context, 73.0% of asthmatic children never admitted to a hospital for the past 6 months, while 18% of the participants said that they have been admitted to a hospital once in the past 6 months. Al-Dawood [3] found similar results as 87.9% of school boys of Al-Khobar city never admitted to a hospital because of asthma (Table 3).

**Conclusion**

The asthma prevalence rate among children was (13%) within the national range (8 - 23%) in the Kingdom, whereas smoking and a history of asthma in the family increased this rate. Future studies are recommended to investigate asthma prevalence based on clinical and laboratory diagnosis to explore the link between asthma and obesity.

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