Prevalence and Severity of Asthma, Rhinitis and Eczema in Pre-School Children in the United Arab Emirates

Introduction: Very few studies have been done on asthma and allergies in pre-schoolchildren. This is the first study in pre-school children in the United Arab Emirates. Methods: We studied 4000 pre-school children from the emirates of Dubai, Sharjah, Abu Dhabi, and Al-Ain cities, 2000 boys and 2000 girls, randomly selected from kindergartens/nurseries, 1-5 years of age. We used the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire. Results: Mean (SD) age, height, weight and BMI were 4.5 (0.75) years, 106.1 (14.2) cm, 17.9 (3.4) kg, and 17.5 (9.3). Prevalence rates of wheeze ever, current wheeze, speech limitation, asthma and dry night cough were 14.7%, 9.6%, 1.8%, 9.8% and 12.0%, respectively. Girls had significantly higher prevalence of speech limitation than boys. The prevalence rates of rhinitis ever, current rhinitis, itchy watery eyes and hay fever were 15.4%, 13.5%, 5.9% and 14.1%, respectively. Girls had significantly higher prevalence rates of itchy watery eyes and hay fever than boys. The prevalence rates of rash ever, current rash and eczema were 8.0%, 6.7% and 16.5%, respectively. Children who breastfed more than 10 months had significantly less prevalence rates of wheeze ever, current wheeze, speech limitation, and asthma, than those who breastfed less than 10 months. Children who were exposed to parental passive smoking had significantly higher prevalence rates of wheeze ever, current wheeze, speech limitation, asthma and dry night cough. Conclusion: The prevalence rates of asthma, rhinitis and eczema were very high. Breastfeeding is protective from asthma. The study can be used as a baseline intervention project to reduce incidents of asthma and allergies in these children and to establish atopic march in order to implement strategies to improve the respiratory health and allergies in these children.

Keywords: asthma, rhinitis, eczema, pre-school children

Introduction

In the developed countries, over one quarter of the population are affected by allergic diseases which are considered as one of the most common problems seen by primary care physicians and pediatricians. Morbidity and school absenteeism, has been correlated with the raised prevalence of asthma, allergic rhinitis, and atopic dermatitis in children. In children and adults, asthma is considered as one of the most widespread chronic diseases. Over the last three decades, the prevalence of asthma has grown in the developed and developing countries.

The International Study of Asthma and Allergies in Children (ISAAC) questionnaire for children and the European Community Respiratory Heath Survey (ECRHS) for adults, which are standardized research instruments, have been presented to add better insight into the worldwide prevalence of asthma and other allergic diseases. (1).

Some studies showed that early exposure to dogs and cats can protect the children from allergic sensitization or the development of asthma, but on the
other hand it suggests that the exposure may increase the risk of allergic sensitization. The prevalence of asthma was decreased in children who were grown up in rural setting because of the presence of endotoxin. (2).

In developed countries, asthma is considered as the most common respiratory disease which affect children, and it affects about 10-30 % of all school age children (3). Litonjua AA (4) and LAU (5) found that maternal history of asthma is known to induce a great risk for childhood asthma and result from environmental factors like the utero-immunologic environment which can confer additional susceptibility.

The International Study of Asthma and Allergies in Children (ISAAC 2005) indicated that there are differences in the prevalence and incidences of asthma, allergic rhinoconjunctivitis and eczema which can be considered as a result of environmental factors including economic development (6), dietary factors (7), Climate (8), infections (9), and pollens (10) which was the same as Litonjua et al’s findings. Godfrey 2002 (3) showed that the U.K had the highest incidence of Asthma (30-35%) comparing to Russia, China and Greece where they had the lowest incidence of asthma (2-5%).

Allergic rhinitis in children is clinically explained as a symptomatic disorder of the nose induced by an IgE-mediated inflammation after allergen exposure of the membranes lining the nose. Rhinitis symptom’s are: rhinorrhea, nasal obstruction, nasal itching, and sneezing which are reversible spontaneously or under treatment. The subdivision of rhinitis disease includes “intermittent” and “persistent”. Regarding the severity of allergic rhinitis, it has been classified into three sections based on its duration and its effect on daily activities (mild, moderate and severe) (11). Allergic rhinitis is considered as a global health problem and it is one of the most common diseases worldwide as it affects 10 to 25% of the population. Actually, many patients do not recognize rhinitis as a disease and therefore do not consult a physician, therefore, the figures probably underestimates the prevalence of the disease (12). Over the last decades, an increasing prevalence of allergic rhinitis has been recognized (13). According to Gregory C. (14), allergic rhinitis has been known as one of the top ten reasons for visiting primary care clinics. Allergic rhinitis significantly changes the social life of patients and affects the learning performance of children in school (15) as well as work productivity (16). Rhinitis’s cost is substantial (17). A large variation in the prevalence of asthma and rhinitis symptoms in children throughout the world had been demonstrated by the ISAAC. In the 6-7 year old age group, the prevalence of rhinitis with itchy-watery eyes “rhinoconjunctivitis” varied from 0.8% to 14.9% and in the age group of 13-14 year old, it varied from 1.4% to 39.7% (18). In school children, the overall correlation between the prevalence of asthma and rhinitis was significant.

The characteristic of the atopic dermititis (AD) is a pruritic dermatitis which is localized in different areas relying on the age of the child. The face and extensors of the lower legs are affected in the infancy, whereas, the flexural areas are commonly involved in childhood. However, in adulthood the
eruption has more diffuse distribution. Xerosis of the skin, early age of onset, and a chronic, relapsing course are important clues to diagnose of eczema (19).

Since early life, wheeze can be refer to several reasons such as respiratory infections, data on asthma in younger pre-school children remains inadequate. However, there are a few studies on the epidemiology of asthma and related symptoms in pre-school children.

Teng Nging Tan (20) conducted a cross sectional prevalence of wheeze, rhinitis and eczema in 7,549 randomly selected Singaporean pre-school aged 4 to 6 years old. Cumulative and past 12 months (current) prevalence of wheeze was 27.5% and 16.0% respectively. Asthma was reported by 11.7%. Current rhinitis prevalence was 25.3% and rhino conjunctivitis was 7.6%, current chronic rash affected 13.5% of subjects while 9.9% reported chronic rash with flexural distribution. After multivariate analysis, the main risk factors for “current wheeze” and self-reported asthma were family history of allergy. The study showed that a considerable portion of pre-school children were affected by these allergy-associated symptoms, which support the need for allergy education and intervention program in this age group.

A study performed by P.Tootoonchi (21) to analyze the prevalence of asthma and related symptoms in children younger than 5 years, a survey was conducted by interviewing mothers of 617 children using ISAAC questionnaire. The overall cumulative and 12 month prevalence of wheezing were 21.9% and 19.4% respectively. The prevalence of exercise-induced wheezing, dry cough without respiratory infections or physician-diagnosed asthma where 18.9%, 11.8% and 3.9%, respectively. There was a high prevalence rates of history of wheezing or exercise-induced wheezing in male sex and in children with positive history of atopy. With the positive history of atopy in the children or maternal age at the child birth less than 20 years or more than 30 years, constant cough unrelated to respiratory infections was strongly associated. Moreover, a physician-diagnosed asthma was extremely associated with positive history of atopy in children.

Another study was performed by Laura B von Kobyletzki (22) to assess the association between eczema in early childhood and the onset of asthma and rhinitis later in life in children. Out of 3,124 children aged 1-2 years, the prevalence of eczema was 17.6% at baseline. Children with eczema had a 3-fold risk of developing asthma, and nearly 3-fold risk of developing rhinitis at follow-up compared with children without eczema. Further independent risk factors increasing the odds of developing asthma were a parental history of allergic disease and a period of breast feeding shorter than 6 months. The incidence of rhinitis was increased for parental history of allergic disease. Thus, during the following 5 years period in infancy, eczema was associated with the development of asthma and rhinitis.

Across-sectional study was carried out by Pereira AM (23) to evaluate the prevalence of current wheezing in preschool children and to examine the association between current wheezing and current rhinitis, considering its severity and persistency. The sample was represented by 5003 Portuguese children aged 3-5 years. Current wheezing prevalence was 24.5% and in the
previous year, 9.4% of the participants had ≥ 4 wheezing episodes. It was found that almost 25% of pre-school children had current wheezing which was strongly associated with rhinitis.

Peroni DG (24) studied the prevalence of atopic dermatitis in a sample of preschool children aged 3-5 years. Children with atopic dermatitis were presented with 32.2% suffering from Rhinitis and 24.2% suffering from wheezing; a high prevalence of atopic dermatitis and a close relationship with rhinitis symptoms.

Another study conducted by Lowe AJ. (25) to investigate whether the infants with atopic eczema were at greater risk of developing asthma and allergic rhinitis than those with non-atopic eczema. The presence of eczema was documented in children up to 2 years of age in a birth cohort of 620 infants with a family history of atopic disease. Skin prick tests (SPTs) at 6, 12, and 24 months using six common allergens, was used to determine the sensitization status. So, in order to determine the presence of asthma and allergic rhinitis, interviews were conducted at 6 and 7 years. The study showed that within the first 2 years of life for children with eczema, SPT can provide a very important data on the risk of childhood asthma and allergic rhinitis.

Four cross-sectional surveys in 5-7 years old children were conducted in seven different communities in Switzerland between 1992 and 2001 by Grize (26). The results showed that the raise in prevalence of asthma and hay fever in 5-7 years old children living in Switzerland may have ceased but atopic dermatitis symptoms may still have increased, especially among girls.

More and more new-fashioned personal products, household appliances, building materials and furnishing materials have been used in residences (1, 2, 27), changing indoor environmental exposures in residences over the past 20 years (2, 3, 27, 28). During the same time period in developed countries (Germany (29), Italy (30), Australia (2) [6], and Switzerland (31), where similar exposures to modern chemicals began many years ago and have plateaued. In developing countries where home environments have recently and rapidly changed, prevalence rates of these diseases and symptoms among children appear to have been increasing (3-7).

Since 1990, several studies have been conducted on childhood asthma, and related diseases or symptoms (8-11, 32-35) and their associations with ambient environmental exposure (36-40), but between 2000 and 2010, there has not been a large-scale study simultaneously conducted in urban and suburban district. Thus it is of interest to investigate to what extent childhood asthma prevalence has increased.

The present study is part of major respiratory epidemiological survey in the UAE. It aims to report the current prevalence and severity of childhood asthma, allergies and other respiratory symptoms in pre-school children in the UAE which can be used in asthma prevention programmes.
Materials and Methods

We used the Arabic and English version of ISAAC questionnaire. We added relevant questions on breastfeeding. All participants’ parents verbally consented for themselves and for the preschool children for whom they responded to questionnaires. Parents of all participants voluntarily responded to the survey. Kindergartens and nurseries have approved this procedure for obtaining consent.

We preliminarily contacted the administrations of the kindergartens / nurseries in the Emirates of Dubai, Sharjah, Abu Dhabi and Al-Ain to include all preschool children. We visited and recommended that the child’s parent fill out the questionnaire.

Study Design

A cross-sectional study was performed as the method of data collection to study the prevalence and severity of asthma, rhinitis, and eczema in pre-school children. Data collection and data analysis were done from October 2015 to October 2017.

Inclusion and Exclusion Criteria

Inclusion Criteria
1- Participants were belonging to Pre-school children in Dubai, Sharjah, Abu Dhabi and al Ain, UAE (Nurseries and Kindergartens).
2- Target age group was under 6 years old.
3- Willing to participate in the study.

Exclusion Criteria
1- Children over 6 years.
2- Not willing to participate in the study.

Study Participants

We studied 4000 Children from nurseries and kindergartens from both genders (2000 males and 2000 females) from different nationalities.
Sampling Method

We studied all children from each kindergarten / nursery in order to complete the required sample size. An ISAAC questionnaire (Arabic and English versions) was used. After the questionnaires were collected, they were carefully checked and coded. Pearson’s chi-squared ($\chi^2$) test was used to test for significance of difference in prevalence between different groups of children. A p-value < 0.05 indicated statistical significance.

The additional questions part consisted of 21 questions to measure other risk factors that can affect the prevalence and severity of asthma, rhinitis, and eczema symptoms in pre-school children. Parents were asked about having household smoker, history of asthma or atopy in the first degree relatives of the child, whether the child was breastfed and some other questions.

Data Collection

A list of all government nurseries was obtained from Education Council. Approval was granted from the Education Council to distribute the questionnaires to be filled in by parents or guardians of the students. Moreover, the questionnaires were also distributed among kindergartens.

Data Analysis

Data was entered and analyzed using SPSS version 20. All questions were coded and then transferred to SPSS for analysis. Descriptive statistical analysis included frequencies for categorical data, we used t-test and chi-square test to compare continuous and categorical variables.

Ethical Issues

Ethical letter to conduct the study was obtained from Ajman University to get the approval of distributing the questionnaires among nurseries and kindergartens. Another ethical letter was obtained from Education Council for distributing the questionnaire among governmental nurseries. Prior to data collection, a written and signed consent form was obtained. At all time, confidentiality of participants was maintained. Participants were informed that they have the right to withdraw from the study at any time they needed, and also they were informed that their participation is voluntary.

Results

A significant differences in weight and height between boys and girls; boys were significantly taller and lighter than girls (Table 1). Boys had a very high significant wheeze ever than girls. They also had high significant current
wheezing and diagnosed asthma than girls but had significantly lower speech limitation than girls (Table 2).

A significant difference in the prevalence of rhinitis symptoms between boys and girls; boys had higher prevalence rates than girls (table 3). Boys had significantly higher prevalence rates of rashes ever, current rashes, rash locations and eczema ever than girls (Table 4).

There was a trend showing higher prevalence of current wheezing, current asthma, incense affecting breathing, perfume affecting breathing among girls compared with boys. Twenty one percent of boys and 27% of girls were exposed to parental smoking (Table 5).

Mean age of onset of asthma for boys and girls was 1.6 year and mean age for recovery from asthma for boys and girls were 1.8 and 1.7 year, respectively. Both boys and girls had the same mean age of onset for Rhinitis which was 1.8 year and the mean age of recovery for boys and girls were the same (1.8, 1.7 year) (Table 6).

The prevalence rates of asthma and asthma symptoms (wheeze ever, current wheezing, number of wheezing attacks, number of sleep disturbances per week, speech limitation, asthma, dry cough and exercise-induced asthma) were significantly higher in children who breastfed less than 10 months compared to those who breastfed more than 10 months (44.0% vs 12.8%, 48.2% vs 9.4%, 40.6% vs 7.7%, 47.7% vs 6.5%, 41.7% vs 1.5%, 29.5% vs 6.3%, 39.2% vs 11.4%, and 42.1% vs 1.7%, respectively) (Table 6).

The prevalence rates of rhinitis symptoms (rhinitis ever, current rhinitis, itchy watery eyes, and hay fever) were significantly higher in children who breastfed less than 10 months compared to those who breastfed more than 10 months (45.5% vs 16.5%, 43.9% vs 14.5%, 43.3% vs 6.5%, and 45.3% vs 4.4%, respectively) (Table 6).

The prevalence rates of eczema symptoms (rash ever, current rash, and eczema) were significantly higher in children who breastfed less than 10 months compared to those who breastfed more than 10 months (42.8% vs 7.3%, 37.1% vs 6.8%, and 63.6% vs 17.1 %, respectively) (Table 6).

Children who exposed to parental smoking had significantly higher prevalence rates of asthma and respiratory symptoms than unexposed children (Table 7). Children whose parents had history of asthma had more prevalence and severity of symptoms of asthma compared to those parents who never had asthma. In general, for all symptoms of asthma, the difference was highly significant (P ≤ 0.001) (Table 8).

There was a very high significant difference in prevalence of rhinitis symptoms in children who had asthma comparing to children who never had asthma. Children without asthma had significantly less prevalence of rhinitis symptoms (Table 9).

There was significant difference in prevalence of eczema symptoms in asthmatic children compared with children without asthma. Children without asthma had significantly less prevalence of eczema symptoms (Table 9).

There was a very high significant difference in prevalence of asthma symptoms in children who had rhinitis compared to children without rhinitis.
Children without rhinitis, had significantly less prevalence of asthma symptoms. Children with rhinitis had significantly higher prevalence of eczema and rashes than children without rhinitis (Table 10). Children with eczema had significantly higher prevalence rates of asthma and respiratory symptoms than children without eczema. There was a high significant difference in prevalence of rhinitis between children with eczema and children without eczema (P ≤ 0.001). Children, who never had eczema, have significantly less prevalence rates of rhinitis symptoms (Table 11). Boys had higher prevalence rates of asthma, eczema, rhinitis, asthma and eczema, asthma and rhinitis, eczema and rhinitis and asthma, rhinitis and eczema than girls (Table 12). The prevalence rates of asthma, rhinitis and eczema was higher in children who breastfed less than 10 months compared with those who breastfed more than 10 months (Table 13).

Discussion

In the present study, current prevalence and severity of asthma, rhinitis and eczema among preschool children in Dubai, Sharjah, Al-Ain and Abu Dhabi (UAE) were reported and analyzed. The global prevalence of asthma among 6–7 and 13–14 year old children were estimated at 14.1% and 11.7%, respectively in 2002 (41). We can speculate that asthma prevalence among different age groups that are presently growing linearly will level at a plateau value as has happened in other countries (42-45) or be in the region of steep increase in a sigmoid curve as in Beijing (46).

The present study, with a relatively large sample size, shows significantly high prevalence of asthma, asthmatic symptoms, rhinitis and eczema. The strength of the upward asthma prevalence trend over the past 22 years is real in spite of the methodological differences among the studies we used. The present study reports more actual prevalence rates whereas earlier reports may have underestimated prevalence rates.

Studies in Chinese preschool children found significantly higher asthma in urban areas than in suburban areas, consistent with other studies (47-50). Also, other Chinese studies have found significantly higher asthma prevalence rates in boys than girls, consistent with many Chinese (47,50,51,52) and international (42,43,44,45,49,53,54) studies. Young boys have a higher asthma prevalence than girls at least until age 13–14 (55) or adolescence (56,57). The time-trend of childhood asthma among 3–7 year old children is most likely well characterized. The present study represents a comprehensive description of asthma, allergy, and airway symptoms or diseases in preschool children in the UAE. It also provides a good reference for national or international studies and comparisons of childhood health issues which will be useful for future similar studies in rapidly developing cities, countries, or regions.

Furthermore, given the parallel exponential uptrends of prevalence rates of childhood asthma in different age groups and of various indicators of rapid modernization in the UAE, we can ask whether the disease increase is
associated with changes in environmental exposures (indoor and outdoor) and family lifestyles that have occurred with rapid modernization (58,59). Many studies have found significant associations between air pollution and childhood asthma and other respiratory diseases and/or symptoms (60). However, the annually averaged concentrations of typical outdoor air pollutants in the Gulf region have trended down. Thus, it is possible that environmental exposures whose sources are indoors rather than outdoors may have stronger associations with childhood asthma than outdoor air pollution (58,59,60-66,67).

It has been previously reported that some environmental factors, including pet-keeping, indoor tobacco smoking, using wood as cooking fuel, living within 200m of a highway or busy road, and home dampness-related indicators, have positive and significant associations with childhood asthma and other diseases or symptoms.

Attention should be given to the health effects of changing environmental exposures with indoor sources due to new-fashioned lifestyles that have developed as the economy in many countries has grown.

1. **Prevalence and severity of symptoms of asthma, allergic rhinitis, and eczema:**

First of all, as for the prevalence and severity of asthma symptoms in all children, we found that the prevalence rates of symptoms of wheezing ever, current wheezing, dry cough and exercises induced asthma were high. However, for speech limitation, there were significant difference between boys and girls. Regarding the prevalence and severity of rhinitis symptoms, there was significant difference in itchy watery eyes between boys and girls (P≤0.05), and there was a trend which showed girls had higher prevalence rates of other rhinitis symptoms.

2. **Effect of breast-feeding, passive smoking and parental history on prevalence and severity of symptoms of asthma, allergic rhinitis, and eczema:**

- **Breastfeeding:**

Although prolonged breastfeeding was shown to reduce the risk of allergic and respiratory disease, still the fact that breastfeeding can prevent allergic disease remains controversial, as there are no reports from developing countries support this issue. In this study, we tried to assess the relationship between breastfeeding and the development of childhood asthma and allergic diseases. We found that there was significant difference in the prevalence of asthma for children who breastfeed more than 10 months compare to children who breastfeed less than 10 months (P≤0.001). However, breastfeeding had no significant effect on the prevalence and severity of rhinitis and eczema. Breastfeeding may be confounded by other factors such as income.
• **Passive smoking:**
  Worldwide, smoking rates are increasing despite all the campaigns to eliminate smoking and hinder the detrimental effects of passive smoking. Children who exposed to passive smoking either in utero or during their adulthood may have an increased prevalence of allergies and asthma. In the present study, referring to table 7, it has been found that children who exposed to parental smoking have significantly higher prevalence rates of asthma symptoms (P≤0.001). Smoking may be confounded by other factors such as income.

• **Parental history:**
  Although heredity has an important role in asthma and in other allergic diseases, it is still poorly understood the mechanisms underlying the inheritance of these disorders. We investigated in this study (table 11) the effect of parental history on the prevalence and severity of asthma, and we found that children, whose parents had history of asthma, had more prevalence and severity of symptoms of asthma compared to those children whose parent never had asthma. The difference was very high significant (P≤0.001).

3. **Recommendation:** As breast feeding has a protective effect in relation to early asthma, it should be encouraged. As passive smoking has significant effect on prevalence and severity of asthma, it should be discouraged. We need to provide effective awareness program for parents about asthmatic patients and all allergic diseases.

4. **Limitations:** In the present study, we have used the ISAAC questionnaire which has been designed for 6-7 years and 13-14 years children, because we do not have specific questionnaire for preschool children.

**Conclusion**

The present study has provided an up to date description of the prevalence and severity of asthma, rhinitis and eczema in preschool children in the U.A.E. In this study, data has illustrated that there is a significant difference of the prevalence and severity of symptoms of asthma and allergic rhinitis between boys and girls; in the symptoms of speech limitation and itchy watery eyes. However, girls showed slightly higher prevalence of eczema ever compared to boys.

In addition to this, results have demonstrated that factors such as breast-feeding, passive smoking and parental history have an important effect on the prevalence and severity of symptoms of asthma, allergic rhinitis and eczema. The data are based on self-reported data. The healthcare organization in U.A.E has to encourage campaigns that are encouraging breast-feeding and discouraging smoking. Add to this, there is a need for asthma education programmes to educate parents and provide awareness about all allergic
diseases. The present study can be used as a baseline study to implement asthma and allergy intervention programmes in children.

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