Factors Responsible for Asthma and Rhinitis among Kuwaiti Schoolchildren

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Abstract
Objective: The aim of this study was to assess the prevalence of asthma among schoolchildren and to determine the level of house dust mites in Kuwaiti homes and its role in asthma and rhinitis. Subjects and Method: The International Study of Asthma and Allergy in Children questionnaire was distributed to schoolchildren in the age group of 5–7 years, after random sampling from all the five governorates of Kuwait. The questionnaires were completed and initiated by parents with the help of the investigator and parents. House dust was collected from the bedroom floor of 549 houses in the same geographical areas where the schoolchildren were sampled, extracted and assayed for mite Der p 1 by ELISA method. Results: The estimated prevalence of asthma was 22.4% and that of rhinitis was 23%. House dust collected from the bedroom floor was found to contain low levels of Der p 1. There was no significant difference (p = 0.969) in the level of Der p 1 between areas in Kuwait. The highest levels of Der p 1 ranged from 0.02 to 0.10 mg/g in 3.5% of the total samples examined. Conclusions: There is a high prevalence of asthma and rhinitis among the schoolchildren in Kuwait. However, the level of dust mitogens investigated in this study was below the level of concern, thus undermining their role in increasing asthma cases in Kuwait. Therefore, further studies are needed to understand the role of other mite allergens and other factors that contribute to the increased prevalence of allergic diseases in Kuwaiti children.

Introduction

Studies conducted in Kuwait have revealed a high prevalence of allergic diseases, especially asthma in children, compared to other countries [1]. Atmospheric pollution due to the prolonged burning of more than 700 oil wells torched during the Gulf War has been considered as one of the reasons for the increase in allergic and respiratory diseases [2]. An analysis of patients admitted to hospital with asthma, as per International Classification of Diseases, before and after the Gulf War (1987–1989 and 1992–1994) showed no statistically significant differences in either hospital admissions or death rates attributable to asthma. However, the number of hospital admissions in young adult Kuwaiti nationals increased in the post-Gulf War period [3]. This prompted us to investigate factors contributing to airway diseases in Kuwait. Asthma and rhinitis are environmental diseases that are caused in most patients by the continual inhalation of allergens of indoor and outdoor origin and the exact sensitivities to these vary among people. It remains to be established which factors contribute to the occurrence of asthma in allergic individuals [4]. Indoor air exposures are more...
strongly linked to the increase in asthma prevalence [5]. Exposure to house dust mites can cause symptoms ranging from atopic dermatitis to bronchial asthma in genetically susceptible individuals and may also exacerbate existing asthma [6,7]. Recent studies did not show major benefits of successful reduction of mite allergens in causing a decrease in asthma or atopic dermatitis symptoms [8,9], but well-controlled studies have provided evidence of a beneficial effect [10,11]. Therefore, we decided to study the prevalence of asthma/rhinitis and the level of house dust mite in Kuwait and its role in asthma and rhinitis.

Materials and Methods

In the present study, dust samples from the bedroom floors of 549 houses in five governorates in Kuwait were collected between July and August 1999 and examined for the dust mite Dermatophagoides pteronyssinus (Der p 1) in order to determine its role in the precipitation of asthma and rhinitis.

Questionnaire

The standard questionnaire of the International Study of Asthma and Allergy in Children was used and distributed to 2,500 schoolchildren on the basis of random sampling from the five governorates. The targeted age groups were the schoolchildren of 5–7 years. The Arabic version of the English-language questionnaire was distributed, and completed by parents with the assistance from the respiratory therapist. A total of 2,117 questionnaires were properly completed; of these, 1,163 were male and 954 female children. The children were born immediately after the first Gulf War and 2 years later.

The completed questionnaires were analyzed using SPSS version 8 and statistical significance was set at p value <0.5.

Collection of House Dust Samples

Five hundred and forty-nine houses from the five governorates of Kuwait were selected for house dust collection of which 111 were from the capital area, 112 from Hawalli, 119 from Farwaniya, 115 from Ahmadi and 92 from Jahra area.

House dust samples were collected using a Hoover Sprint 100 vacuum cleaner (model SI 211, The Hoover Co., Canton, Ohio, USA). The vacuum cleaner was adapted to collect the dust samples onto an 8-inch squared sheet of bed linen. A dust trap located behind the cleaner attachment supported the sheet. The sample was collected from an area of 1 m² for 2 min. The sheet and dust sample were stored at 4°C in mini grip lock bags.

Extraction

The dust was sieved through a No. 45 mesh screen, 355 μm in diameter (VWR No. 57332146) to remove large particles and fibers. Fine dust particles were weighed (100 ± 5 mg) and put into a 75 × 12 mm plastic test tube (Sarstedt Co., Nürnberg, Germany) and 2.0 ml PBS-T (0.05% Tween 20 in phosphate-buffered saline, pH 7.4) was added. The dust was suspended using a vortex mixer (Vortex-Genie, Fisher Scientific, Bohemia, N.Y., USA) for 2 h at room temperature or at 4°C overnight. The suspension was centrifuged for 20 min at 2,500 rpm at 4°C. The supernatant (approximately 1.5 ml) was removed with a Pasteur pipette and stored at −20°C for the measurement of antigen and the pellet was discarded.

ELISA Protocol for Mite Der p 1 Determination

The method of Chapman et al. [12] was used for determination of Der p 1 as given below. Anti-Der p 1 mAb 5H8, HPLC purified procured as a stock solution at 2 mg/ml in PBS and anti-Der f 1 mAb 6A8 freeze-dried ammonium sulfate fraction of ascites was suspended in 1 ml PBS at 10 mg/ml concentration. Polyethylene microtiter wells (Immulon II) were coated with either 200 ng/well 5H8 or 1 mg/well of 6A8 (i.e. 0.1 ml 1/1,000 dilution of mAb) in 50 mM carbonate buffer, pH 9.6, overnight at 40°C. The wells were washed twice with PBS-T (PBS with 0.05% Tween 20, pH 7.4) and incubated for 1 h with 0.1 ml 1% bovine serum albumin PBS-T then washed twice with PBS-T and dried; 0.1 ml of diluted allergen samples were added and incubated for 1 h. House dust samples were routinely diluted twofold from 1/10 to 1/80. A control curve was made using doubling dilutions of a reference Der p 1, dilutions being from 250 to 0.5 ng/ml Der p 1. The wells were washed 5 times with PBS-T and incubated for 1 h with 0.1 ml 1/1,000 dilution of biotinylated 4C1 (equivalent to 16 ng 4C1 antibody). This mAb was used as a second antibody for Der p 1. The values of Der p 1 were calculated as micrograms per gram of dust and ranked on the basis of suggested guidelines for the categorization of the Dermatophagoides mite allergen levels in house dust mites (table 1).

### Table 1. Guidelines for the *Dermatophagoides* mite allergen levels in house dust

| Mites | Comment | Rank |
|-------|---------|------|
| <2 μg Der p 1/g dust | not sufficient to cause allergic symptoms | low |
| 2–10 μg Der p 1/g dust | risk for sensitization and bronchial hyperactivity | significant |
| >10 μg Der p 1/g dust | risk for acute asthmatic attack | high |
Results

Of the 2,117 schoolchildren analyzed in this study, 471 (22.4%) reported wheezing and 261 (12.4%) rhinitis in the last 12 months (Table 2). Three hundred and fifty (16.5%, 229 male and 121 female) reported to have been diagnosed with asthma by the attending physician; 485 (23%) reported sneezing, 315 (15%) sneezing and itching indicative of allergic rhinitis, and 230 (11%) reported a physician’s diagnosis of allergic rhinitis. Reported prevalence of asthma was 22.4% and that of allergic rhinitis was 23%.

The frequency of Der p 1 level in Kuwaiti house dust is given in Table 3. Based on the classification in Table 1, the frequency of Der p 1 in the 549 houses examined was as follows: zero to not significant: 515 (93.6%); extremely low (i.e. <0.02 μg/g): 15 (2.7%); slightly more (0.02–0.10 μg/g) but not sufficient to cause any allergic symptoms: 19 (3.5%) (Table 3). None of the dust samples examined contained significant or high levels of Der p 1 with a risk for sensitization and bronchial hyperactivity. The distribution in various areas of Kuwait also showed no significant difference (p value = 0.969) in the pattern of Der p 1 between areas in Kuwait (Table 3). However, the highest levels were detected in the Capital area and Hawalli followed by Ahmadi, Jahra and Farwaniya governorates.

Discussion

The role of indoor aeroallergens is increasingly evidenced worldwide in the development of asthma, and among indoor allergens house dust mites are the most common source [13–16]. The prevalence of asthma (22%) and that of allergic rhinitis (23%) were higher than those of other studies from Italy, Switzerland (24.6 and 12%, respectively), and Hong Kong (7%) [17], but lower than that of the United Kingdom (15.6%) [18]. Equally important, the prevalence of asthma in Kuwait was higher than

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**Table 2. Prevalence of wheezing/rhinitis symptoms of different frequency and severity**

|                | Boys | Girls | Total |
|----------------|------|-------|-------|
|                | n    | %     | n     | %    | n    | %    |
| **Sex**        |      |       |       |      |      |      |
| boys           | 1,163| 54.9  | 954   | 45.1 | 2,117| 100  |
| girls          | 314  | 27.4  | 157   | 16.5 | 471  | 22.4 |
| **Wheeze ever**| 178  | 15.5  | 83    | 8.7  | 261  | 12.4 |
| 1–3 episodes   | 97   | 8.3   | 80    | 8.4  | 177  | 8.4  |
| 4–12 episodes  | 25   | 2.1   | 17    | 1.7  | 42   | 2    |
| >12 episodes   | 12   | 1.1   | 11    | 1.1  | 23   | 1.1  |
| **Nocturnal wheeze in the past** |      |       |       |      |      |      |
| < 1 night per week | 60 | 5.1   | 43    | 4.5  | 103  | 4.9  |
| > 1 night per week | 53 | 4.5   | 41    | 4.2  | 94   | 4.4  |
| **Asthma diagnosis by physician** |      |       |       |      |      |      |
| yes            | 229  | 20.7  | 121   | 12.7 | 350  | 16.5 |
| no             | 122  | 10.7  | 62    | 6.5  | 184  | 8.8  |
| **Nocturnal cough in the last year** |      |       |       |      |      |      |
| yes            | 351  | 37.6  | 242   | 25.3 | 593  | 27.5 |
| no             | 279  | 24.4  | 206   | 21.6 | 485  | 22.7 |
| **Exercise-induced wheeze** |      |       |       |      |      |      |
| yes            | 165  | 14.1  | 150   | 15.1 | 315  | 15.1 |
| **Physician’s diagnosis of allergic rhinitis** |      |       |       |      |      |      |
| yes            | 138  | 12.1  | 92    | 9.7  | 230  | 11   |

*p < 0.001. n = Number of students.

**Table 3. Frequency of Der p 1 level in house dust from five governorates of Kuwait**

| Area governorate | Der p1 levels | Total |
|------------------|---------------|-------|
|                  | 0             | <0.2  | 0.2–1.0 |
| Capital          | 102 (19.8)    | 4     | 5 (10.3) |
| Hawalli          | 104 (20.2)    | 3     | 5 (10.3) |
| Farwaniya        | 114 (22.1)    | 3     | 2 (10.5) |
| Ahmadi           | 108 (21.0)    | 3     | 4 (21.1) |
| Jahra            | 87 (16.9)     | 2     | 3 (15.8) |

**Total** 515 15 19 549

Figures in parentheses indicate percentages. p = 0.969.
that reported from UAE (6–7%) and Saudi Arabia (10.3%) [19].

Although the present study was conducted on bedroom dust, apparently the most important room in the house, only 2.7 and 3.5% of the houses had extremely low (<0.02 µg/g) and slightly higher (0.02–0.10 µg/g) levels of Der p 1, suggesting that dust mite allergen levels were below the level of concern that could cause any allergic symptoms, i.e. risk for sensitization and bronchial hyperactivity. The distribution pattern of Der p 1 also showed no significant difference (p value = 0.969) between different areas in Kuwait (table 3). The main limitations of this study were the lack of objective measurement of lung function and allergic phenotypes like food allergy and atopic dermatitis.

Conclusion

There is a high prevalence of asthma and rhinitis among schoolchildren in Kuwait. However, the level of house dust mite allergen was below the level of concern, thus undermining its role in increasing asthma cases in Kuwait. Further studies of the role of other mite allergens and other factors that contribute to the high prevalence of allergic diseases in Kuwaiti children are needed.

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