DOI: https://doi.org/10.5455/JPMA.27705

Research Article
Association of serum IgE levels with severity of asthma in children

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Abstract
Objective: To determine the association between serum IgE levels and severity of asthma in children.

Methods: A descriptive cross sectional study was conducted at the department of Pediatric Pulmonology of The Children’s Hospital and The Institute of Child Health Lahore from January 2016 to December 2016. This study included 160 asthmatic children of both genders between 3-16 years, were categorized for asthma severity and serum IgE level was measured in all patients.

Results: Mean age of children was 7.32±4.012 years. Mean serum IgE level was 141.36±97.879 IU/ml. Asthma of higher severity was present in patients
with serum IgE concentration of >100 IU/ml (50% and 66.7%) in moderate persistent and severe persistent group respectively (p=0.02). Similarly, more severe disease was present in older age group (p=<0.001) and in male gender (p=<0.001).

**Conclusion:** Asthmatic children with persistent asthma were older in age and children with higher asthma severity had a higher serum concentration of IgE.

**Keywords:** Asthma severity, children, IgE, asthma

**Introduction**

Asthma is the most important cause of childhood chronic disability resulting in a huge health burden in terms of prevalence, morbidity and cost.\(^1\) A prevalence of 11.2- 29.5% in children below the age of 18 years is shown in recent studies.\(^2,3\) Although the cause of childhood asthma has not been pinpointed, contemporary research implicated an interplay between genetic and environmental factors. The term atopy was introduced as all the allergic disorders are not simply Immunoglobulin E (IgE) medicated, i.e., there are non-IgE mediated allergic disorders also.\(^4\)

The application of serum total IgE and its correlation with atopy and allergic diseases remain a focus of research interest all over the world as there has been an increase in prevalence of allergic disorders. Moreover, both physicians and parents are eager to obtain prompt identification of children with allergic diseases.\(^5\) An elevation in serum IgE levels is a marker of allergic inflammation and atopy and is considered a potent predictor of asthma development.\(^6-7\)
Literature search revealed that serum IgE levels are elevated in asthmatics and these levels increase significantly with the severity of the asthma. Moderate and severe asthma were associated with high levels of total IgE especially in children and in adults whose asthma began in childhood. However, these findings are not consistent across studies. Few studies reported conflicting results showing IgE levels are elevated significantly in asthmatic patient but no significant difference was observed among patients with varying degree of severity of asthma. We planned this study to analyze the serum IgE levels in children with bronchial asthma and to determine the association of the severity of airway obstruction with serum IgE level.

Patients and Methods

It was a descriptive cross sectional study conducted at the Pediatric Pulmonology out-patient department of The Children’s Hospital and The Institute of Child Health Lahore which is a Tertiary care teaching hospital. The sample size was calculated by using Open epi statistical calculator with 95% confidence level and 5% margin of error and taking the prevalence of childhood asthma as 11.6%. Samples were collected over a period of one year from January 2016 to December 2016. After informed consent from parent/patients, total 160 patients of both genders aged between 3-16 years were selected and enrolled by non-probability consecutive sampling. Patients with physicians made diagnosis of asthma (coughing worse at night and early morning for ≥6months) and spirometry by Forced Expiratory Volume in 1 sec (FEV1) ≤80% of predicted were taken. Written Spirometry was conducted on all
patients by using Spirolab, a new generation spirometer. Serum IgE levels were measured in all subjects using a standard Immulite assay by ELISA method (free for patients at hospital lab). All the spirometric examinations were conducted by a single resident and all the labs were acquired from the same (Hospital Lab) to eliminate bias. IgE level ≥100IU/ml was labelled as raised. Serum IgE as a predictor of atopy/asthma was classified as follow:

- Atopy improbable < 20 IU/ml
- Atopy not be excluded 21-100 IU/ml
- Atopy very probable > 100 IU/ml

Patients with any other respiratory co-morbidity like pneumonia (high grade fever ≥102°F, cough, expectorant, radiological evidence of consolidation; radio-opaque shadow in the lung field), pulmonary tuberculosis (low grade evening fever≥100°F, weight loss ≥5Kg, history of contact, radiological evidence of cavitation; radiolucent shadow in the lung field, consolidation; radio-opaque shadow in the lung field, pleural effusion), or having symptoms of allergic rhinitis, atopic dermatitis, skin lesions and Job’s syndrome were excluded. Patient’s demographic details, duration of asthma and serum IgE levels were noted and recorded into predesigned proforma. All the collected data was analyzed through SPSS version 20. Qualitative variable such as gender and hospital admission were presented as frequency. For quantitative variables, such as age and serum IgE levels mean and standard deviation was calculated. Chi square test was used to compare the serum IgE level and asthma severity. A p-value of <0.05 was considered as significant. Data has been stratified for age, gender and severity of asthma to address effect modifiers.
Results
The age of the patients ranged from 3 years to 16 years with a mean of 7.32±4.012 years. Majority (n=101, 63.0%) of the children were aged between 5-16 years. There were 111 (69.4%) male and 49 (30.6%) female patients in the study group. Majority of the children had severe persistent (n=60, 37.5%) and moderate persistent (n=58, 36.3%) asthma respectively. The serum IgE level ranged from 12 IU/ml to 500 IU/ml with a mean of 141.36±97.879 IU/ml (Table 1). In mild intermittent asthma majority (80%) had serum IgE in range of 21-100 IU/ml. The frequency of raised serum IgE level was significantly higher i.e. >100 IU/ml among severe persistent (n=40; 66.7% vs. n=12; 32.4%) as compared to mild persistent asthma (p=0.020) (Table 2).
A significant difference of asthma severity was seen across all age and gender as more children in older age group had moderate or severe persistent asthma (n=42; 72.4% and n= 45; 75%) respectively (p=<0.001) and more males in moderate to severe persistent asthma (n=39; 67.2% and n= 55; 91.7%) respectively (p=<0.001) (Table 3).
Similarly, children in older age group of 5-16 years had higher serum IgE levels i.e. >100 IU/ml in (n=73; 89%) as compared to younger children 09 (11%) (p=<0.001) and higher serum IgE in male sex (n=62; 75.6%) as compared to females 20 (24.4%) (p=0.002).

Discussion
Asthma in children has been associated with respiratory allergies and high serum IgE levels. For the development of asthma, IgE has been shown to be a major contributing factor and an elevation in serum IgE levels is considered to be a potent predictor of asthma development. Various studies from around the world have shown higher IgE levels in asthmatic patients than in non-asthmatic persons. In our study the asthmatic children had higher mean value of serum IgE consistent with atopy and a study done by Stromgaard which showed that airway hyper-responsiveness was a significant predictor of serum total IgE in children.

A trend is shown in serum IgE levels i.e. much higher percentage (66.7%) in severe persistent group had >100IU/ml of serum IgE. This result has shown the important role of IgE in the severity of asthma. Similar consistent results were shown in a study published in Archives of Integrative Medicine in which 75% of children with asthma had raised serum IgE levels. The relationship between risk of asthma and serum IgE is well established in children and adults in various studies. The serum IgE level ranged from 21.68 IU/ml to 625.56 IU/ml with a mean of 270.57±197.90 IU/ml. Results of our study showed that serum IgE level was significantly higher in children having persistent or severe asthma as majority had IgE level >20 IU/ml and only 12 (7.5%) had IgE level <20 IU/ml. This is consistent with the findings of a study by Satwani which showed that in children serum IgE level is a good predictor of allergy. Similarly a study by Borish and another study by Kumar et al showed consistent results in which children with severe asthma had a significantly higher mean IgE level as compared to children having moderate or mild asthma. Another study from India showed that the IgE levels increased as the severity of asthma increased,
however, there was no statistically significant correlation because there was large variability in each category of asthma.\textsuperscript{6} Extensive literature search revealed that a correlation exist between severity of asthma and IgE levels and the higher IgE is related with lower lung functions.\textsuperscript{4,16} There are conflicting results regarding the relationship of asthma severity with serum total IgE in children. A local study published in PJMS showed that there was no significant difference in serum IgE levels among different grades of asthma.\textsuperscript{10}

In our study the age of patients ranged from 3 years to 16 years with a mean of 7.32±4.0 years. A slightly higher mean age of 8.92±1.93 years in children with asthma was observed in a study from Bangladesh.\textsuperscript{4} Comparatively lower mean age of 6.93±2.63 years among Indian children with asthma was reported in a study by Chaudhuri in 2013.\textsuperscript{7} There were preponderance of males in our study group giving a male: female ratio of 2:1. A similar male predominance among asthmatic children was observed by Borish et al and a study published in Ind J Clin Biochem.\textsuperscript{7,13} This may signify male preference in South East Asia.

In our study, male children with asthma had significantly higher IgE level as compared to females consistent with a study among Asian children showing male, allergic diseases, atopy and recent upper respiratory infection were associated with higher total IgE levels in univariate analyses.\textsuperscript{19} The results of our data revealed that serum IgE levels were significantly different among different age groups with \( p \) value of 0.02. In our study, serum IgE levels were significantly associated with older age group consistent with a study by Haselkorn showing that IgE levels were higher in boys with the highest levels at 12–14 years.\textsuperscript{20,21}
The present study is first of its kind in local population and has found the frequency of raised serum IgE level to be significantly higher among moderate and severe persistent asthmatic children compared to mild persistent and intermittent asthma. The high serum IgE levels were also associated with older age and male gender.

**Limitations**

This was a single centered study limits the generalization of our results.

**Conclusion**

Serum IgE levels were high in asthmatics children especially in moderate and severe persistent group. Higher IgE is related with severe asthma in children and as the severity of asthma increased, the serum IgE levels also increased.

**Disclaimer:** None to declare.

**Conflict of Interest:** None

**Funding disclosure:** Nothing to disclose.

**References**


19. Yu-Ling Tu, Su-Wei Chang, Hui-Ju Tsai, Li-Chen Chen, Wen-I Lee, Man-Chin Hua, Ju-Hui Cheng, Liang-Shiou Ou, Kuo-Wei Yeh, Jing-


Table 1: Demographic Characteristics of the Study Population

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Asthmatic Children n=160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>111 (69.4%)</td>
</tr>
<tr>
<td>Female</td>
<td>49 (30.6%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td></td>
</tr>
<tr>
<td>Mean Age</td>
<td>7.32±4.012</td>
</tr>
<tr>
<td>&lt;5 years</td>
<td>59 (37%)</td>
</tr>
<tr>
<td>5-16 years</td>
<td>101 (63%)</td>
</tr>
<tr>
<td>Serum IgE level</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>141.36±97.879</td>
</tr>
<tr>
<td>&lt;20 IU/ml</td>
<td>12 (7.5%)</td>
</tr>
<tr>
<td>20-100 IU/ml</td>
<td>66 (41.3%)</td>
</tr>
<tr>
<td>&gt;100 IU/ml</td>
<td>82 (51.2%)</td>
</tr>
<tr>
<td>Asthma Severity</td>
<td></td>
</tr>
<tr>
<td>Mild intermittent</td>
<td>5 (3%)</td>
</tr>
<tr>
<td>Mild Persistent</td>
<td>37 (23%)</td>
</tr>
<tr>
<td>Moderate Persistent</td>
<td>58 (36.4%)</td>
</tr>
<tr>
<td>Severe Persistent</td>
<td>60 (37.6%)</td>
</tr>
</tbody>
</table>

Table 2: Association of Serum IgE Levels with Severity of Asthma

n=160
### Table 3: Association of Severity of Asthma with Age and Gender

<table>
<thead>
<tr>
<th>Variable</th>
<th>Asthma Severity</th>
<th></th>
<th>Total</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild Intermittent</td>
<td>Mild Persistent</td>
<td>Moderate Persistent</td>
<td>Severe Persistent</td>
</tr>
<tr>
<td>Patient’s age</td>
<td>&lt; 20 IU/ml</td>
<td>20-100 IU/ml</td>
<td>&gt;100 IU/ml</td>
<td></td>
</tr>
<tr>
<td>5 years</td>
<td>5 (100%)</td>
<td>23 (62%)</td>
<td>16 (27.6%)</td>
<td>15 (25%)</td>
</tr>
<tr>
<td>5-16 years</td>
<td>0 (0%)</td>
<td>14 (38%)</td>
<td>42 (72.4%)</td>
<td>45 (75%)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>1 (20%)</td>
<td>16 (43%)</td>
<td>39 (67%)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4 (80%)</td>
<td>21 (57%)</td>
<td>19 (33%)</td>
</tr>
</tbody>
</table>