Relation between Asthma and Body Mass

Index in 6-15 Years Old Children

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Abstract- Childhood asthma and obesity are significant public health problems. Most prospective studies suggest that obesity increases the risk of asthma. But, some authors did not found this association. In this study the association between asthma and body mass index (BMI) was investigated. This case-control study was conducted on 200 asthmatic children aged 6-15 years and 200 children without asthma. The criteria for asthma diagnosis and its classification were on the basis of National Asthma Education and Prevention Program (NAEPP). BMI of patients and controls were also measured and BMI greater than 85% and 95% were defined as overweight and obese respectively. The data was analyzed by SPSS software. The BMI among the asthmatic children (17.9 kg/m²) was higher than the BMI among the non-asthmatics (16.5 kg/m²), \( P=0.0001 \). This relationship was significant in both males and females. 18% of asthmatic children were classified as overweight and 13.5% of them were obese versus 7.5% and 6% respectively in non asthmatics \( P=0.0001 \). However, there was no significant relationship between severity, duration of asthma, kind of medication and BMI in children with asthma \( P>0.05 \). Result of this study showed that there is an association between asthma symptoms and obesity in children. Therefore, any attempts for weight control in asthmatic children might be beneficial.

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Keywords: Asthma; BMI; Obesity; Overweight

Introduction

In recent decades the prevalence of many chronic disorders such as asthma and obesity has dramatically increased (1,2). These disorders are influenced by genetic and environmental factors and could be associated with many important co-morbidities such as cardiovascular disorders, hypertension, metabolic syndrome, diabetes and psychological disorders (1-4).

This rising trends will put heavy burden on social and health services. Therefore exploring the effective factors and preventive measures could be beneficial. The role of some inflammatory events and mechanisms in obese patients was identified as predisposing factors for asthma development and several investigators introduced increased asthma and obstructive pulmonary disorders in obese and overweight patients (5-10). However, there are several studies that did not show any association between asthma and obesity (11-15). Some limited studies have shown increased prevalence of obesity in asthmatic patients (16,17).

It is unclear were this association might be affected by mechanical and restrictive effects of obesity on respiratory system, or obesity may be arise from limitation of activity and medications in asthmatics. This study investigates the prevalence of overweight and obesity in children and youth with asthma and its association with the severity of asthma.

Materials and Methods

This study was carried out in Allergy and Pediatric Clinic of Mousavi Hospital in Zanjan City (Zanjan, Iran) from March to September 2010 in 6-15 years children with diagnosed asthma and similar children without asthma that serially recruited to study. Patients with asthma were ascertained by history, clinical findings and pulmonary function tests and their allergic status was
confirmed by at least one positive skin prick test (wheal diameter at least 3 mm) to common allergens including: tree, grass, weed, cockroach, mite, cat or mold. The severity of disease in asthmatic group was also classified to mild, moderate and severe on the basis of NAEPP guideline (18).

Non-asthmatic children were outpatients of pediatric clinic who attended for acute illness such as cold or sore throat without history of asthma or allergic disorders. Patients with chronic systemic disorders such as cystic fibrosis, cardiac, renal and gastrointestinal diseases were excluded from study.

Height (m) and weight (kg) of all subjects were measured during the clinic visit by a trained person with Seca scale (769 Digital Column Scale). BMI was calculated as weight (kg)/height² (m²) and was converted into age and gender specific BMI percentiles on the basis of CDC growth chart and overweight was defined as BMI>85th and obese as BMI>95th percentile (19). Study was approved by Ethic committee of Zanjan University of Medical Sciences and all subjects or their parents filled the informed consent before study. Furthermore, parents were questioned about severity, duration of asthma and any medication being administered to the children. Data was analyzed by SPSS software student t-test for parametric data and Chi-square analysis was used for categorical measures. The odds ratio (OR) was calculated with the 95% confidence interval (CI) and P-value less than 0.05 was considered statistically significant.

Results

In this study 400 children (200 asthmatics, 200 non-asthmatics) with mean age 9.6 ± 2.6 were evaluated. The gender and ages of cases and control group were similar (P-values were 0.92 and 1, respectively).

The height of asthmatic and non-asthmatic group was similar. But, there was statistically significant difference between the weight of asthmatic and control. Furthermore, the BMI among the asthmatic children (17.9 kg/m²) was significantly higher than the BMI among the non-asthmatics (16.5 kg/m²), P=0.0001 (Table 1).

In differential analyses of data from girls and boys, asthmatic children had significantly higher weight and BMI. This relationship was significant in both boys and girls (Table 2).

Thirty six (18%) of asthmatic children were classified as overweight (OR: 3.13, 95% CI: 1.65-5.95) and 27 (13.5%) of them were obese (OR: 2.44, 95% CI: 1.2-4.97). Whereas the frequency of overweight and obesity in control group was 15 (7.5%) and 12 (6%) respectively, (P=0.0001).

We did not find significant association between severity and duration of asthma with obesity or overweight in children with asthma (P>0.05). Atopic sensitization, as assessed by skin prick tests, was non-significantly related to BMI (Table 3).

There was no association between kinds of medication in asthmatic children and their BMI ratio.

### Table 1. Weight, height and BMI levels in asthmatic and non-asthmatic children.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Group</th>
<th>Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>Asthmatic</td>
<td>33.26 (12.007)</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Non-asthmatic</td>
<td>30.89 (10.944)</td>
<td></td>
</tr>
<tr>
<td>Height</td>
<td>Asthmatic</td>
<td>134.21 (14.66)</td>
<td>0.056</td>
</tr>
<tr>
<td></td>
<td>Non-asthmatic</td>
<td>134.46 (14.13)</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td>Asthmatic</td>
<td>17.91 (3.58)</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>Non-asthmatic</td>
<td>16.56 (2.95)</td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. BMI measures in asthmatic boys and girls vs. non asthmatic children.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Groups</th>
<th>No</th>
<th>BMI Mean (SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>Asthmatic</td>
<td>104</td>
<td>18.01 (3.53)</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>Non-asthmatic</td>
<td>105</td>
<td>16.44 (2.74)</td>
<td></td>
</tr>
<tr>
<td>Girls</td>
<td>Asthmatic</td>
<td>96</td>
<td>17.8 (3.65)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Non-asthmatic</td>
<td>95</td>
<td>16.69 (3.17)</td>
<td></td>
</tr>
</tbody>
</table>
Table 3. Asthma severity, atopic status and duration of disease in normal weight, overweight and obese asthmatic children.

<table>
<thead>
<tr>
<th>Variability</th>
<th>Normal weight</th>
<th>Overweight</th>
<th>Obese</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number (%)</td>
<td>137 (68)</td>
<td>36 (18)</td>
<td>27 (13)</td>
<td></td>
</tr>
<tr>
<td>Asthma severity:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild</td>
<td>76</td>
<td>19</td>
<td>11</td>
<td>0.645</td>
</tr>
<tr>
<td>Moderate</td>
<td>45</td>
<td>14</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>16</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Atopy</td>
<td>85</td>
<td>22</td>
<td>17</td>
<td>0.87</td>
</tr>
<tr>
<td>Asthma Duration</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>month</td>
<td>23.13</td>
<td>22.69</td>
<td>23.7</td>
<td>0.97</td>
</tr>
<tr>
<td>SD</td>
<td>(15.99)</td>
<td>(16.96)</td>
<td>(15.39)</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

In this study the weight and BMI of asthmatic patients was significantly greater than children without asthma. Some studies were in agreement with our study (16,17,20). Previous studies also showed increasing risk of asthma in overweight and obese population (6-10,21-23).

There are several possible mechanisms explaining this relationship, including: reduction of functional residual capacity (FRC) and tidal volume (TV) in obese patients and increasing production of inflammatory adipokines such as: IL-6, eotaxin, TNF-α, monocyte chemotactic protein (MCP-1) and leptin (5,24,25). In contrast, some investigations didn’t find any association between BMI and asthma (11-15).

This disparity might be mediated through other factors such as genetic, habitual and environmental factors in different population or could be result from the differences in sample size.

Several studies were shown this relation only in girls especially in adolescence (4,10,26-28). However, our finding was similar to studies of Oddy et al. (29) and Tai et al. (20) that found this association in both boys and girls. Although, there are some investigations that demonstrated this relation was more prevalent in boys (21,30).

In this study obesity and overweight didn’t related on severity of asthma. It is in constant with study of Hom et al. who found no association between BMI and emergency department admission rates in children with asthma (31). Lung et al. showed obese asthmatics were not at greater risk for asthma exacerbation or higher treatment burden than normal weight children with asthma (32). However there are several studies implicated a positive association between obesity and asthma severity and also attenuated response to inhaled corticosteroids (10,33,34).

Similar to some previous studies, we didn’t find any relation between BMI and atopic status of asthmatic children (8,29). However there were several studies that show more prevalence of atopy among overweight and obese individuals (27,30,35,36).

We didn’t evaluate activity of asthmatic patients, however asthma duration and medications were not related to overweight and obesity. These factors could be influence on activity and eating habits of asthmatic patients. Von Mutuis et al. demonstrated that the time spent watching TV and the frequency of exercising per week was also not associated with asthma (8). In contrast Tsai et al. found a significant interaction between asthma and BMI on time spent in moderate and vigorous activity (37).

In conclusion there were significant association between asthma and overweight and obesity as determined by increasing BMI level. Thus any intervention for prevention and control of these disorders could be improved health and quality of life.

Acknowledgment

This study is graduated thesis of Dr Sara Tabbakhha and approved by research committee of Metabolic Disease Research Center of Zanjan University of Medical Sciences. We acknowledge patients and their parents who participated in this study.

References

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