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Exposure Pattern of House Dust Mites in Childhood Asthma Along the Year: A Series of 10 Cases

Zakkiudin Munasaki, Lenny S Budi, Titi Sulayro, Sri Rezeki H Hadinegoro

(Department of Child Health, Medical School, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta)

ABSTRACT House dust mite (HDM) is one of the inhalant allergens causing inflammation of respiratory tract. More than 100 dust mites/gram house dust may cause sensitization in childhood asthma, while more than >500 house dust mite/gram house dust may cause asthma attack. This report aimed to determine the exposure pattern of house dust mites on 10 asthmatic children during one year. Home visit to all patients was done every month to obtain house dust sample, measurement of relative humidity, bed room temperature, and to evaluate the clinical scores and peak expiratory flow rate (PEFR). The range value of house dust mite/gram house dust was 0-340. This study shows that house dust mite may cause of acute asthma attack when accompanied by nonspecific stimuli. In September the relative humidity is high, the temperature is low, and the amount of house dust mite/gram of house dust is highest, in contrast to in August and December. This study shows no seasonal variation. The amount of house dust mite/gram of house dust was found higher at the mattress than in the floor of bed room. The species of house dust mite that predo- minantly found is Dermato- phagodes pteronyssinus. We conclude that house dust mite may cause acute asthmatic attack whenever accompanied by nonspecific stimulus. [Pediatr Indones 1999; 39:201-210]

Introduction

Asthma is a chronic disease commonly encountered in daily practice and is a leading cause of school absence. The prevalence of childhood asthma in the world varies from less than 1% to more than 20%. A study in Central Jakarta found 6.9% among 243 children under 14 years old suffered from asthma. The majority of children with
Exposure pattern of house dust mites in childhood asthma

asthma has allergy, a family history of atopy, and positive skin test. The three most commonly found allergens based on positive skin test are house dust, animal skin flakes, and house dust mites. A large proportion of asthmatic children show positive skin test for house dust mite, as seen from studies in Australia (90%), United States (70-80%), Argentina (82.1%), Thailand (94-76%), and Indonesia (84%). Inflammation seems to be accepted as the cause of bronchial hyperreactivity which is responsible for the occurrence of asthma. House dust mite is one of the inhaled allergens causing inflammation in the respiratory tract, but asthma attack still needed by non-specific stimuli.

Studies done in the Netherlands and England revealed an association between the clinical features of asthmatic children with exposure to house dust mites; however, studies done in Australia and Israel failed to prove such an association. Hoppus dust mite count of more than 100/gram of house dust but less than 500/gram of house dust is assumed to only cause sensitization to house dust mites in asthmatic patients. The species encountered most in an environment is *Dermatophagoides pteronyssinus*. Other studies conducted in the Netherlands and the United States showed that exposure to house dust mites was related to seasonal variation whereas a study in Australia did not. The aim of this study was to determine the prevalence of positive skin test for house dust mite in asthmatic children, the clinical features of asthmatic children exposed to house dust mites during one whole year, and the pattern house dust mite count per gram house dust in each month.

Methods

This was a prospective serial cases design, to know the exposure pattern of house dust mites in 10 asthmatic children patients during in year. The study included all asthmatic patients treated for the first time in the Pediatric Allergy-Immunology Polyclinic during 1997, which were 58 patients. Subjects were part of the 58 patients who had (+++) skin test to house dust mites; with this criterion, 22 persons were eligible for further study. Of them, those who aged between 6-18 years old, lived in Jakarta, and had FEV1 <80% than the predicted value outside an attack were selected. Patients who were on continuous corticosteroid treatment were excluded. Finally, this study obtained 10 patients.

The diagnosis of asthma was based on history, physical examination and laboratory finding (leukocyte count, total IgE, total eosinophil and FEV1). At the beginning of every month during 1998 a house visit was done to collect dust sample, to obtain data of clinical score and PEFR and to determine the relative humidity and the temperature of the bedroom. The dust sample from the bed was collected by using a vacuum cleaner (National no. MC 1035) for 2 minutes for every 1 m², while dust sample from the bedroom floor was collected from under the bed, and 1 m from the bed.

House dust mites were counted by using a floating technique with light microscope Olympus SZ 296787 under the magnification of 2-4x10. The relative humidity and temperature were measured using an instrument called Relative Humidity Fire Comfort Barigo German. PEFR is conducted at 6 o'clock in the morning and 7 o'clock in the evening with the patient standing before using an oral disc bronchodilator and inhaled. Peak expiratory flow was done 3 times at the same time to obtain the highest value. Clinical score is recorded at night before going to bed by using an evaluation form. The hygiene and sanitation of the environment especially in the bedroom, needs to be cared for during the study.

Results

During the period of January 1st, 1997 until December 31st, 1997 the number of patients treated for the first time in the Pediatric Allergy-Immunology Polyclinic of FKUI/RSCM were 241 children, 58 of which were asthmatic patients; 47 children (81%) had positive skin test to house dust mite (*Dermatophagoides pteronyssinus*). From those 47 children, 22 had (+++) or (++++) the skin test result. Ten patients were available for further study. From the 10 asthmatic patients, the were 6 boys and 4 girls, 8 were in the early school age and 2 in the late school age, all had +++ or ++++ skin test to house dust mites and were in the category of a moderate degree of asthma.

Clinical features of wheezing and PEFR

In this study, the range of the amount of house dust mites/gram of house dust varies from 0 to 340. In this study the clinical features of asthma can be mild or severe in the situation where no house dust mites are found as well as in the case where the amount of house dust mites/gram of house dust.

The highest amount of house dust mites/gram of house dust (127/gram of house dust) on the mattress is found in September, which is in conformity with the highest relative humidity (70%) and the lowest temperature (28°C) in the bedroom. The lowest amount of house dust mites/gram of house dust on the mattress is found in August and December (46 and 26/gram of house dust respectively) which is in accordance with the lowest relative humidity (54% each) and the highest temperature (33°C each). In this study no seasonal variation is found.

During this study, the average amount of house dust mites/gram of house dust on the mattress every month is always found higher than that on the bedroom floor. The species mostly found on the mattress as well as on the bedroom floor is *Dermatophagoides pteronyssinus* (72% and 55.4% respectively), followed by *Glycyphagus destructor* (12.7% and 26.5% respectively). *Cheyletus eruditus* is found both on the mattress and the bedroom floor (5.4% and 10.2% respectively). *Cheyletus eruditus* is a predator to the other species of house dust mites.
Table 1. Patient characteristics

<table>
<thead>
<tr>
<th>No.</th>
<th>Initial</th>
<th>Sex</th>
<th>Age (year)</th>
<th>FEV1 (L/second) (% predictive)</th>
<th>Skin test</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>H</td>
<td>girl</td>
<td>17</td>
<td>2.21 (78.9)</td>
<td>(+++)</td>
</tr>
<tr>
<td>2.</td>
<td>I</td>
<td>boy</td>
<td>10</td>
<td>1.33 (79.6)</td>
<td>(++++)</td>
</tr>
<tr>
<td>3.</td>
<td>N</td>
<td>girl</td>
<td>8</td>
<td>1.41 (66.0)</td>
<td>(++++)</td>
</tr>
<tr>
<td>4.</td>
<td>N</td>
<td>girl</td>
<td>10</td>
<td>1.52 (76.7)</td>
<td>(+++)</td>
</tr>
<tr>
<td>5.</td>
<td>O</td>
<td>boy</td>
<td>6</td>
<td>1.0 (67.1)</td>
<td>(+++)</td>
</tr>
<tr>
<td>6.</td>
<td>P</td>
<td>boy</td>
<td>9</td>
<td>1.06 (71.1)</td>
<td>(++++)</td>
</tr>
<tr>
<td>7.</td>
<td>R</td>
<td>boy</td>
<td>6</td>
<td>0.94 (75.8)</td>
<td>(+++)</td>
</tr>
<tr>
<td>8.</td>
<td>R</td>
<td>boy</td>
<td>8</td>
<td>1.08 (73.9)</td>
<td>(+++)</td>
</tr>
<tr>
<td>9.</td>
<td>S</td>
<td>girl</td>
<td>15</td>
<td>2.13 (76.0)</td>
<td>(+++)</td>
</tr>
<tr>
<td>10.</td>
<td>Y</td>
<td>boy</td>
<td>12</td>
<td>1.55 (78.2)</td>
<td>(+++)</td>
</tr>
</tbody>
</table>

Figure 1. The number of house dust mites/gram of house dust and clinical score of wheezing.

Figures 2 and 3. Correlation between number of house dust mites/gram of house dust and PEFR (in the morning and evening).

Figure 4. The number of house dust mites/gram of house dust on the mattress and the relative humidity in the bedroom every month.
Table 2. Type of species of house dust mites found on the mattress along the year

<table>
<thead>
<tr>
<th>Species</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatophagoides pteronyssinus</td>
<td>6,797</td>
<td>72.00</td>
</tr>
<tr>
<td>Glycyphagus destructor</td>
<td>1,199</td>
<td>12.70</td>
</tr>
<tr>
<td>Dermatophagoides farinae</td>
<td>702</td>
<td>7.44</td>
</tr>
<tr>
<td>Cheyletus eruditus</td>
<td>508</td>
<td>5.38</td>
</tr>
<tr>
<td>Dermatophagoides microsera</td>
<td>170</td>
<td>1.80</td>
</tr>
<tr>
<td>Acarus siro</td>
<td>64</td>
<td>0.68</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9,440</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Table 3. Type of species of house dust mites found on the bedroom floor along the year

<table>
<thead>
<tr>
<th>Species</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermatophagoides pteronyssinus</td>
<td>3,374</td>
<td>55.41</td>
</tr>
<tr>
<td>Glycyphagus destructor</td>
<td>1,614</td>
<td>26.51</td>
</tr>
<tr>
<td>Cheyletus eruditus</td>
<td>622</td>
<td>10.21</td>
</tr>
<tr>
<td>Dermatophagoides farinae</td>
<td>256</td>
<td>4.20</td>
</tr>
<tr>
<td>Dermatophagoides microsera</td>
<td>156</td>
<td>2.54</td>
</tr>
<tr>
<td>Acarus siro</td>
<td>69</td>
<td>1.13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>6,090</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

Discussion

In this study, the reason for using asthmatic patients with a skin test of \(+{++}+\) is that it is in accordance with the study done by Kuno Saka2 where there was a correlation of 77% between skin test and test of specific IgE against house dust mites. In this study the prevalence of positive skin test with house dust mites is 81%, which agrees with the studies done in the USA, Argentina and Thailand but is lower than that in Australia and higher than that in Indonesia.13-15
In this study the clinical feature of childhood asthma can be mild or severe on case where no house dust mites are found, and also in cases where the amount of dust mites/gram of house dust is highest for the whole year. Hence, it can be assumed that in order to induce an acute asthmatic attack a non-specific stimulus is needed. This seems to agree with the studies conducted in Australia,\(^a\)\(^b\) and Israel\(^a\) and support the theory proposed by Platts-Mills,\(^a\) Dian-Sanches\(^b\) and Frenikle,\(^a\) but it disagrees with the done in the Netherlands,\(^b\) and England.\(^a\)

The range of relative humidity and temperature needed for the multiplication of house dust mites in this study agrees with the result obtained by Voorshorst\(^a\) and Speikema.\(^a\) During this study, the average amount of house dust mites/gram of house dust found on the mattress every month is always higher than that on the bedroom floor. This result agrees with that obtained by Aulung,\(^b\) Voorshorst\(^a\) and Godfrey.\(^a\) \(^b\)\(^a\)\(^b\) The species encountered most on the mattress as well as on the bedroom floor are *Dermatophagoides pteronyssinus* (72.0\% and 55.4\% respectively). This agrees with the studies done previously.\(^a\)\(^b\)\(^c\)\(^d\)\(^e\)\(^f\)\(^g\) *Dermatophagoides pteronyssinus* propagates optimally at a temperature of 25\(\text{C}\) and a continuously high relative humidity, which is in accordance with the condition in Indonesia. If an environment of a population, especially asthmatic patients, contain a large amount of *Dermatophagoides pteronyssinus*, then a Der p 1 allergen extract should be used for the skin test.\(^a\)\(^b\)\(^c\)\(^d\)\(^e\)\(^f\)\(^g\)

In this study, *Cheyletus etudatus* species is also found which is a predator to other house dust mites. It seems that the amount of house dust mites <500/gram of house dust is due to the presence of this species.

Therefore in this study, the role of house dust mites in inducing an acute asthmatic attack still need to be accompanied by a non-specific stimulus. Seasonal variation is not found in this study, hence the sanitation of asthmatic patient's environment has to cared for every time.

### References

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