Sensitization to food and pollen allergens and their implication for travelers with respiratory allergies

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Abstract. Respiratory allergies, i.e. asthma and allergic rhinitis, are typically induced by inhalant allergens such as house dust mite allergens. During travel, these persons may also be exposed to other type of allergens that potentially trigger hypersensitivity reactions. However, sensitization pattern of respiratory allergic patients to allergens associated with traveling (such as peanut, sea food, and grass pollens) is not known. The aim of this study was to evaluate allergen sensitization pattern among adult patients with respiratory allergies. A cross-sectional study was done in respiratory allergic patients between September and December 2016. Adult asthmatic patients aged 19 to 60 years were invited to undergo skin prick test at the Allergy and Immunology Clinic, Cipto Mangunkusumo Hospital, Jakarta. A total of 105 cases were enrolled; 80 (76.2%) were women. Sixty-two patients (59%) had both asthma and allergic rhinitis. Sensitization to food allergens was mostly found to shrimp (36.2%), egg (33.3%), crab (30.5%), peanut (28.6%) and tuna (28.6%), while sensitization to grass pollens was found in 11.4% patients. As conclusion, about 72.4% people with a history of asthma or allergic rhinitis triggered by the house dust mites are also sensitive to at least one food allergen and 11.4% was sensitive to grass pollens. These allergens are potential inducers of allergic symptoms when traveling or holiday, especially during air-travel (peanut allergy) or spring season (pollen allergy).

1. Introduction
Respiratory allergies, i.e. asthma and allergic rhinitis, are typically induced by inhalant allergens such as house dust mite (HDM), which are the major source of allergens worldwide [1]. Environmental control is important strategy to prevent contact with allergens and thereby preventing symptoms [2,3]. Therefore, atopic individual should know their potential allergens that may induce hypersensitivity reaction. This can be achieved by performing IgE antibody testing; either in vivo using skin prick test (SPT) or in vitro using immunoassay test [4].

When people travel, they leave behind their usual environment and enter another environment, which is possibly different from their hometown. In the new destination, allergens distribution and pattern may be different from their home environment. Fortunately, lack of previous sensitization may prevent allergic reaction that potentially ruins the purpose of travel. However, allergic reaction can still occur if the traveler has some degree of sensitization.
Allergic people are also at risk of an in-flight emergency, some among them may occur for the first time during flight. The prevalence of in-flight medical emergencies occurred up to 44,000 cases annually with 4% resulting in hospitalization or death [5]. During air travel, systemic allergic reaction (SAR), anaphylaxis and asthma exacerbation may occur. However, these problems have not received proper attention from the travelers. [6] SAR cases during flight are mostly triggered by food allergen in peanuts and tree nuts [7]. There is also a report of anaphylaxis after insecticide spray [8].

Although most people with food allergy are aware about their condition, persons with respiratory allergy may not know their potential sensitization. Moreover, different environment, season, and climate can also bring other type of inhalant allergen, such as grass pollen. In this regard, knowing the potential allergen that may cause reaction in the destination will be helpful for prevention. However, sensitization pattern data among respiratory allergic patients in Indonesia is largely not known. Therefore, the aim of this study was to evaluate allergen sensitization pattern among adult patients with respiratory allergies.

2. Method

2.1. Study design and subjects
This was a cross-sectional study in patients with a history of respiratory allergy in Jakarta, Indonesia between September and December 2016. Adult asthmatic patients aged 19-60 years were invited to undergo serum specific IgE testing at the Allergy and Immunology Clinic, Cipto Mangunkusumo Hospital, Jakarta. Patients were included if they had no contraindication to undergo skin prick testing (SPT) and showed at least one positive result. There are no exclusion criteria in this study.

2.2. Skin-prick test
The skin prick test was performed on the volar side of the forearm. The skin was disinfected with 70% alcohol and then was marked with a pen. Drops of allergen extract were applied on the skin. Each drop contained one tested allergen (Stallergens, SA, France). A sterile lancet (Stallerpoint, Stallergens, SA, France) was used to prick the skin through the allergen drops. Each lancet was used for one allergen. Positive control (histamine) and negative control (normal saline) were included. Assessment of the forearm was done after 15 minutes. The excess of allergen drop was wiped out. The reaction was positive if there was a wheal with a diameter of at least 3 mm with a flare. The allergen panel consisted of 19 allergens, i.e. egg, peanut, soy, sardine, tuna, shrimp, crab, cocoa, Aspergillus mix, Candida, Alternaria, grass mix, cat, dog, guinea pig, Dermatophagoides pteronyssinus, Dermatophagoides farinae, Blomia tropicalis, and cockroach. Grass mix allergens consisted of bent grass, Bermuda grass (Cynodon dactylon), bromus, cockfoot, meadow fescue, meadow grass, oat grass, rye grass, sweet vernal grass, timothy, wild oat, and Yorkshire fog.

2.3. Statistical analyses
Demography data and asthma severity were presented descriptively. Distribution of positive allergens on SPT was described as frequency and percentage.

3. Results

3.1. Characteristics of the study subjects
One hundred and five subjects were enrolled in this study; 80 (76.2%) were women. Patients’ mean age was 38.9 ± 12.1 years old, ranging from 19 to 59 years old. Majority of patients (59%) had both asthma and allergic rhinitis. Skin prick test for major house dust mites (HDM) showed Blomia tropicalis as the most common allergen (table 1). Most patients (89.5%) had at least one positive test to HDM allergen.
Table 1. Characteristics of the study subjects (n=105).

| Characteristics                  | n (%)      |
|----------------------------------|-----------|
| Gender                           |           |
| Female                           | 80 (76.2%)|
| Male                             | 25 (23.8%)|
| Diagnosis                        |           |
| Asthma                           | 25 (23.8) |
| Asthma and allergic rhinitis     | 62 (59.0) |
| Allergic rhinitis                | 18 (17.1) |
| Sensitization to major house dust mites |        |
| Blomia tropicalis                | 81 (77.1) |
| Dermatophagoides pteronyssinus   | 75 (71.4) |
| Dermatophagoides farinae         | 74 (70.5) |

3.2. Sensitization to other allergens
There 76 (72.4%) patients who had at least one positive SPT on food allergens. Sensitization to food allergens was mostly to shrimp (36.2%), followed by egg (33.3%), crab (30.5%), peanut (28.6%), and tuna (28.6%). Sixty patients (57.1%) were sensitive to at least one seafood allergen. Sensitization to grass pollens was found in 11.4% patients (table 2).

Table 2. Sensitization pattern by skin-prick test in respiratory allergic patients (n=105).

| Characteristics  | n (%)      |
|------------------|-----------|
| Food allergens   |           |
| Shrimp           | 38 (36.2) |
| Whole egg        | 35 (33.3) |
| Crab             | 32 (30.5) |
| Peanut           | 30 (28.6) |
| Tuna             | 30 (28.6) |
| Sardine          | 28 (26.7) |
| Cacao            | 24 (22.9) |
| Soybean          | 23 (21.9) |
| Pollen allergens |           |
| Grass-mix        | 12 (11.4) |

4. Discussion
Traveling with allergic disease raises a whole new set of challenges, which may not be aware by the allergic traveler. This study is the first in Indonesia that address the potential harm that one with respiratory allergy can encounter when traveling. Our current data confirmed that HDM is the most important allergen among patients with allergic asthma and/or rhinitis as almost 90% of them was positive to at least one HDM allergen. In this respect, the patient may not aware that he or she may have a risk of food or pollen allergic reaction especially if there was no history of previous attack.
In this study, 72.4% patients showed sensitivity to food allergens and more than half (57.1%) was sensitized to at least one seafood allergen. These numbers may be high, but without history of clinical symptoms the diagnosis of food allergy cannot be established. The prevalence of food allergy in adult
Indonesian population is not known. The only data available from a pediatric clinic showed that sensitivity to food allergen was found in 20-30% patients with atopic dermatitis [9].

Sensitization to grass pollens occurs in 11.4% of patients in this study. This was lower than a previous report in Jakarta wider area (36.2%). In addition, there was also sensitization to cogon grass pollen that was higher than normal subjects (20.3% vs. 8.7%; p = 0.053) [10]. Cogon grass is not cultivated but grows easily everywhere and is considered as an invasive weed in Indonesia [11]. Grass pollens in a tropical country like Indonesia have perennial distribution, which potentially has allergenic protein or glycoprotein. However, in subtropical regions, outdoor allergens usually are seasonal and its distribution depends on the geography, climates and vegetation [12].

Allergy to grass pollens has been widely studied in temperate climates and now has been recognized as an important inhalant allergen all over the world [13]. Timothy and ryegrass pollens from temperate zones are the most clinically predominant pollen allergen worldwide [14,15], but subtropical grass pollens (e.g. Bermuda grass) seem to be more important allergen sources than temperate grass pollens [13].

This study showed that among patients with respiratory allergy sensitive to HDM, other type of allergens also existed and may potentially harmful. Although allergic symptoms can only manifest after long exposure to an allergen, responsiveness or sensitivity to environmental allergens varies greatly among individuals. We should point out that a sensitization to peanut was positive in 28.6% of patients. It was slightly lower than the sensitivity to seafood (either shrimp or crab) and egg. These patients are clearly at risk of having allergic reaction when they consume peanuts or seafood during travel. In addition, some people were also sensitive to grass pollens. This could be harmful when travel during pollen season (spring). It is therefore important to include sensitivity pattern assessment during pre-travel visit in people with known history of respiratory allergy.

5. Conclusion
Patients with respiratory allergy triggered by house dust mites also showed some degree of sensitization to food (especially seafood, peanut, and egg) and grass pollen allergens. This sensitivity pattern warrants special attention from the patients as the allergens can induce allergic symptoms when traveling, especially during air-travel (peanut allergy) or spring season (pollen allergy).

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