Tolerance to Baked Banana in Adult with Banana Anaphylaxis: A Case Report

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Abstract

Bananas are one of the most consumed fruits in the world with enriched nutrients. Although allergy to banana is rare, it can occur in both children and adults with varying clinical presentation ranging from oral allergy syndrome to anaphylaxis.

Banana is a complex allergen including both heat labile and heat stable parts of proteins. As far as known, the heat stable allergen or linear epitope in their molecular structure usually plays a significant role in a case of anaphylaxis.

Here we report 59-year-old woman who experienced anaphylaxis following the ingestion of raw Pisang awak banana (glûay-nám-wáa). Interestingly, this patient shows substantial evidence of immunoglobulin E (IgE) reactivity to the banana but can tolerate baked banana.

Keywords: banana anaphylaxis, banana allergy, food allergy, anaphylaxis, banana

Food allergy is defined as "an adverse reaction to food in which immunological mechanisms have been demonstrated." [1] The increae in the prevalence of food allergy was reported as about 3.5%-5% of the general population [2] and 8% of the paediatric population.[3] The characteristic of food-induced allergic disorders have been defined as IgE-mediated, cell-mediated and mixed (IgE and cell-mediated).[2] Prevalence of adverse reactions to fruits was reported in 2.2-11.5% of children and 0.4-6.6% of adults.[4] Among fresh fruit, banana is not a common cause of fruit allergy, but it can cause life-threatening symptoms. Banana allergy is characterized as banana hypersensitivity, cross reaction to birch tree or pollen known as oral allergy syndrome and the latex-fruit syndrome which often occurs in patients sensitive to latex. Here we reported a case of a patient who experienced banana anaphylaxis without latex or pollen allergy and can tolerate baked banana.

Case Report

A case of 59-year-old Thai woman with generalized pruritic urticarial rash, rhinorrhea, nasal obstruction and shortness of breath after 30 minutes following the ingestion of two pieces of raw *Pisang awak* banana (glûay-nám-wáa) (Figure 1) together with paracetamol 1,000 mg. At the emergency room, blood pressure 160/90 mmHg, pulse rate 80/min, respiratory rate 15/min, body temperature 37.2°C. The physical examination revealed good consciousness, end expiratory rhonchi both lungs, nasal swelling, angioedema both eyelids with generalized urticarial rash, and organ presented within normal limits. Food-induced anaphylaxis was diagnosed and adrenaline (1:1,000) 0.5 mL intramuscular was given to her immediately with the rapid response of her clinical syptoms within an hour. Unfortunately, a late phase reaction occurred 3 hours later. She was then admitted as an inpatient for a day and discharged with self-epinephrine auto injection. Serum tryptase 2 hours after the onset of reaction revealed 19.10 ug/L (1.9-13.5).



Pisang awak banana (glûay-nám-wáa) | Cavendish banana (k̂lwy līxm) | Lebmuernang banana

Figure 1: The type of bananas

She was referred to the allergy clinic at Ramathibodi hospital for further evaluation to ascertain the cause of anaphylaxis. A complete history was taken and this found that she had experienced two anaphylaxis events in her life. The first event was five months prior to this reaction, happened after she ate raw *Pisang awak* banana and mushroom for 1 hour, she had the same response (nasal swelling, angioedema both eyelids with urticarial rash) and was treated with intramuscular adrenaline (1:1,000) 0.5 mL. After this event, she avoided mushroom and banana. The second anaphylaxis event as described above. After this event, the patient was self-administering paracetamol without any reaction and still avoiding all bananas.

She suspected banana anaphylaxis from her history and laboratory investigation. She can eat all kinds of fruits such as jackfruit, kiwi or chestnut without any reaction. She can apply latex gloves or latex balloon as usual. We also evaluated others allergic diseases which found that she had non-allergic rhinitis and her underlying disease was seizures; her current medications were phenytoin, clonazepam and aspirin.

At the preliminary investigation for banana anaphylaxis, we performed the skin prick test. The histamine and normal saline were used as positive and negative control respectively. Skin prick test was considered positive when a wheal of more than 2 mm in diameter presented after 15 minutes. The result of skin prick test using commercial food allergens (ALK®) showed positive (4 mm) which was relevant to her symptoms and negative for mushroom. Other allergens including black pepper (3mm), peanut (3 mm), soybean (5 mm) and garlic (4 mm) were positive results but she is able to eat these foods without any allergic reaction.

To improve the accuracy of the skin test, we performed prick to prick skin test using raw *Pisang awak* banana, which revealed strongly positive 21 mm wheal size with a pseudopod. The specific IgE immunoblot for food profile and specific IgE to peanut were all negative. Eventually, the specific IgE to latex (ImmunoCAP®) was class 1 positive without clinical relevancy, so we performed the latex application test which presented a negative result. The latex allergy was excluded. We did not perform oral raw *Pisang awak* banana challenge test due to convincing history and laboratory result of anaphylaxis. We diagnosed banana anaphylaxis and advised to avoid all kinds of banana.

Later, she accidentally ate an amount of baked *Cavendish* banana cake (Khêk k̂lwy h̄xm) without any reaction. This was surprising given her history. So the prick to prick skin test with raw *Cavendish* banana and Lebmuernang banana (Figure 1) were performed which showed strongly positive results (18 mm, 10 mm of the wheal size with pseudopod, respectively). But a negative result was found to baked banana (*Cavendish* banana in a banana cake and *Pisang awak* banana in a Thai bakery baked banana with sticky rice or Khaotummud). We performed the oral food challenge test to confirm the tolerability to baked banana and the result showed she could eat one and a quarter cups of the baked *Cavendish* banana and two pieces of Khaotummud (baked banana with sticky rice) without any reaction.

In summary, the final diagnosis was raw banana anaphylaxis, we advised a patient to avoid all kinds of raw bananas but could eat all sorts of baked banana and should always carry a self-epinephrine autoinjection kit.

Discussion

We reported a 59-year-old woman experienced two times of *Pisang awak* banana anaphylaxis. As far as known, this is the first case report of banana anaphylaxis in a patient that can tolerate baked banana. The allergology workup revealed evidence of an IgE-mediated pathway, the skin prick tests using both the commercial extract and raw bananas were strongly positive results. We diagnosed the banana allergy without the oral provocation test because of the convincing clinical perspective. Even though the serum

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specific IgE to latex was positive (class I) the skin prick test and the latex application test confirmed the exclusion of latex allergy.

In previous studies, banana allergy was reported in both adults and infants (rare condition)[2,5-7] with a variety of clinical reactions. It often occurs in patients sensitized to pollen, known as oral allergy syndrome and latex-fruit syndrome.[8] Banana allergy is much less common in patients without allergy to latex and pollinosis.[8] However, there are few reports of this condition.[9,10]

The immunoglobulin E (IgE) binding epitopes in allergens contribute to allergenicity and are seen as a prediction of clinical severity and the development of tolerance.[11,12] Food allergens are classified into (i) Class I food allergen and (ii) Class II food allergens. Class I food allergens are also called 'true' or 'complete' food allergens that act as a primary sensitization via the gut, leading to symptoms upon ingestion of the food. The linear IgE epitopes were displayed in class I food allergen which is often associated with the severe systemic reaction and related to the high stability of high temperature and the digestive enzyme.[13] Class II food allergen is elicited as a consequence of primary sensitization to homologous allergens particularly inhalant allergen and subsequent IgE cross-reactivity to homologous food allergen. Class II food allergens are frequently associated with mild oral or mild systemic reactions and related with the low stability of these conditions.[14,15]

Banana is a complex allergen contains both heat stable and heat labile proteins. The molecular basis of banana allergy composed of at least five allergens (i) profilin (Mus a 1); (ii) class I chitinase (Mus a 2, 31 kDa; (iii) non-specific lipid transfer protein (Mus a 3); (iv) thaumatin-like protein (Mus a 4, 21 kDa) and; (v) beta-1,3-glucanase (Mus a 5, 33 kDa).[16-20] The major allergens are Mus a 2, Mus a 4 and Mus a 5.[10,16]

The possibility of heat labile allergens was taken into account in this case and resulted in the baked banana tolerability. Unfortunately, we could not perform any further investigation to prove this hypothesis. In conclusion it is possible that the baked banana oral provocation test has a role in some patients with banana anaphylaxis in addition to the skin prick test, in vitro test for specific IgE and raw oral provocation test.

Conclusion

Banana allergy has a diverse spectrum of reactions from mild to life-threatening symptoms depending on the sensitized allergens. Some cases of banana anaphylaxis can tolerate baked banana.

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