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Anaphylaxis after ingestion of dust mite *(Dermatophagoides farinae)*-contaminated food: A case report

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Abstract. Domestic mites have been recognized as the most common allergen responsible for respiratory allergy. Herein, we report a case of anaphylaxis due to ingestion of dust mite-contaminated food. A 14-year-old boy presented to the Emergency Department with chest discomfort, wheezing, eyelid angioedema, and urticarial rash twice in a month after eating meals, including tempura fried squids and onion fritters (containing wheat flour, eggs, squid, and onion). Anaphylaxis had been diagnosed and successfully treated. The investigations showed that the patient was sensitive to house dust mites. Positive skin prick-to-prick test response to incriminated flour and negative tests to wheat allergen extract and uncontaminated flour were demonstrated. The microscopic analysis of causative cooking flour identified the presence of *Dermatophagoides farinae.* During the oral food challenge test, the patient was able to eat tempura-fried squids and onion fritters, made with uncontaminated flour, without any adverse reaction. Hence, oral ingestion of dust mite-contaminated food was the culprit of this severe allergic reaction.

INTRODUCTION

Anaphylaxis is an acute serious systemic hypersensitivity reaction which can be fatal. It requires immediate diagnosis and treatment. Food is the most common cause of anaphylaxis around the world (Dhami & Sheikh, 2017; Rangkakulnuwat *et al.*, 2020; Chaaban *et al.*, 2019). Domestic dust mites (*Dermatophagoides farinae*, and *Dermatophagoides pteronyssinus*) have been identified to be the most common allergen sources responsible for the pathogenesis of respiratory allergy, especially asthma and allergic rhinitis (Malainual *et al.*, 1995, Thomas, 2010). The major route of dust mite exposure causing hypersensitivity reactions had been thought to be by inhalation. However, in 1993, anaphylaxis caused by the ingestion of mite-contaminated foods was first described by Erben *et al.* (Erben *et al.*, 1993). Since then, a number of patients with 'oral mite anaphylaxis' have been described in different parts of the world (Tay *et al.*, 2008; Sanchez-Borges *et al.*, 2013; Takahashi *et al.*, 2014; Sanchez-Borges & Fernandez-Caldas, 2015). It has now been widely recognized that mites should be regarded as a potential hidden food allergen (Sanchez-Borges & Fernandez-Caldas, 2015). Here we report a rare case of anaphylaxis in a teenager caused by ingestion of mite-contaminated food which is likely to be overlooked by clinicians.

CASE REPORT

A 14-year-old boy presented to the Emergency Department (ED) at Chiang Mai University Hospital, Chiang Mai, Thailand with chest discomfort, eyelid and lip swelling, and an urticarial rash which started about ten minutes after having meals. On arrival at the ED, his blood pressure, pulse rate, and oxygen saturation were within normal limits,

but his respiratory rate was rapid at 30 breaths/min. The physical examination revealed generalized urticaria, eyelid and lip angioedema. Wheezing was auscultated over both lung fields. Anaphylaxis was diagnosed and immediate treatment with intramuscular epinephrine, intravenous antihistamine and corticosteroids was given. He fully recovered after the treatment.

The patient had a similar episode of anaphylaxis one month before the incident. The symptoms started about 15 minutes after having a different meal at home. The triggering foods of the previous and present episodes were onion fritters and tempura fried squids. The foods were freshly prepared by the patient's mother. He insisted that all food ingredients had been consumed before several times without any problem. No other family members who had eaten the same foods with the patient had any adverse reaction.

Furthermore, the patient had a history of Naproxen (non-steroidal anti-inflammatory drug; NSAID) hypersensitivity in the last two years. He complained of having rashes after eating shrimp several years ago. Neither personal history of allergic rhinitis and asthma nor allergic history in the family was identified.

Investigations

The patient's mother prepared onion fritters and tempura fried squids at home using cooking flour (Gogi®, Bangkok, Thailand, containing 90% wheat flour, 6% tapioca, 3% baking powder), eggs, cooking oil, squids, and onion. The same cooking flour from the same container was used to cook both foods. It was purchased two weeks ago within a sealed package from the manufacturer, then was unpacked and had been kept in a reused closed plastic container in the kitchen's cupboard.

The mother provided a sample of the kept cooking flour. The gross appearance of the flour showed a color change which may imply some contamination (Figure 1). Under a stereomicroscope, living mites, mite feces, and mite's molt were seen with the total count of ~18,310 mites/1 gram of flour. *D. farinae* was then identified by the entomologist at the Department of Parasitology, Faculty of Medicine, Chiang Mai University using a light microscope (Olympus CX41 with Olympus DP22 digital camera, Olympus Corporation, Tokyo, Japan) and the key of Matthew J. Colloff (2009) for dust mites (Colloff & SpringerLink (Online service), 2009) (Figure 2).

Figure 1. Gross Appearance of the Cooking Flour.

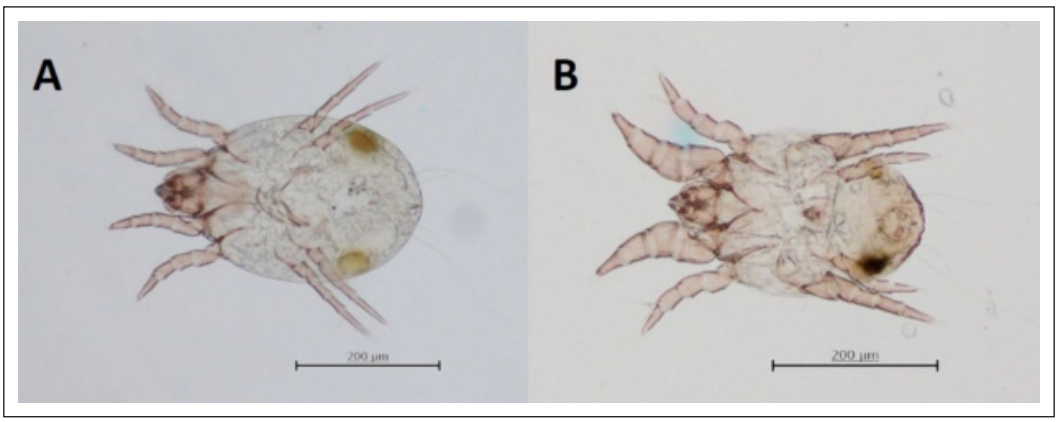

Figure 2. *Dermatophagoides farinae* (A: female, B: male; light microscopic with 10x objective lens).

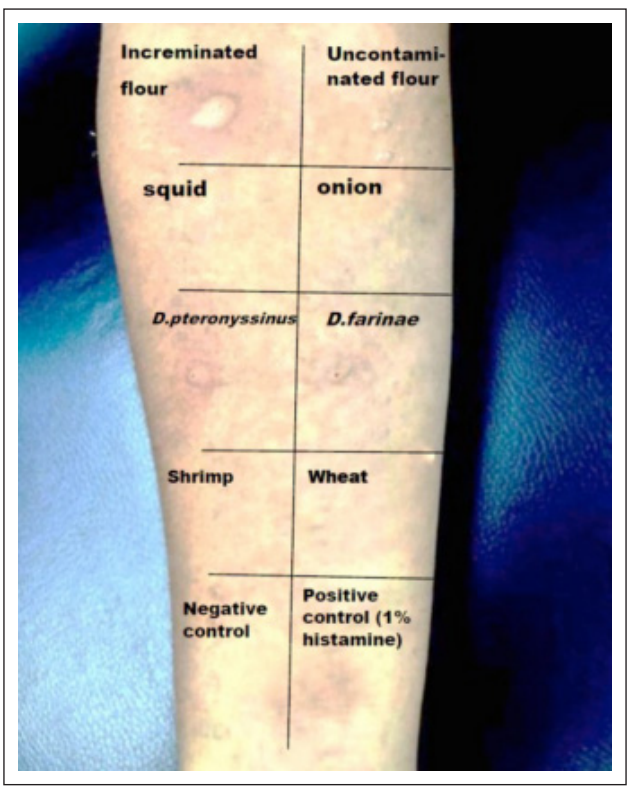

Figure 3. Skin Prick Test Results.

A skin prick test (SPT) was performed using commercial allergen extracts (Alk ABello®, Port Washington, NY, USA). The patient had a positive skin prick test for both dust mites, *D. farinae*, and *D. pteronyssinus*, but negative results for wheat grain and shrimp. We also performed skin prick test with a prick-to-prick method (Bernstein *et al.*, 2008) using the kept cooking flour from the patient's kitchen, newly opened cooking flour from the manufacturer's package (Gogi®), cooked squid and cooked onion. The results revealed positive only for the kept cooking flour (Figure 3).

Table 1. Specific IgE Results*

Allergen	Value (kUa/L)
D. pteronyssinus	6.54
D. farinae	7.86
Shrimp	1.37
Wheat	2.69
Squid	1.80

* ImmunoCAP, Thermo Fisher, USA.

Specific IgE in the blood was determined by ImmunoCAP®, (Thermo Fisher, USA) and results are shown in Table 1 with a cut-off value of 0.35 kUa/L. It revealed positive to *D. farinae*, *D. pteronyssinus*, shrimp, and wheat. In order to identify the culprits, we performed the oral food challenge tests with squid, onion, shrimp, and newly opened (uncontaminated) cooking flour. Shrimp was included in our investigation to exclude allergen cross-reactivity and to confirm clinical relevant with laboratory results. Patients passed all the oral food challenge test without any reactions.

DISCUSSION

We have demonstrated a case of anaphylaxis due to ingestion of mite contaminated food or 'oral mite anaphylaxis' which was confirmed by means of the microscopic identification of *D. farinae* in the contaminated flour. The patient fulfilled the described criteria for the diagnosis of oral mite anaphylaxis (Sanchez-Borges *et al.*, 2013) which is based on clinical and laboratory characteristics of 1) rapid onset of symptoms occurring after wheat-flour food intake 2) *in vivo* or *in vitro* testing demonstrating IgE-mediated sensitization to mite allergen 3) positive immediate-type skin test with suspected flour 4) negative skin test to wheat and to uncontaminated flour 5) clinical tolerance to food made with uncontaminated flour 6) mite identified in suspected flour on microscopic examination and 7) hypersensitivity to NSAIDs.

In this case, we suspected oral mite anaphylaxis rather than other ingredients in suspected foods because of the reaction to food made with flour which had been previously tolerated. Although oral food challenge with contaminated flour was not done regarded patient's history of severe reactions, strongly positive results of sensitivity to house dust mites and contaminated flour, and a negative result for uncontaminated flour, squid and onion supported our diagnosis.

However, there were weakly positive sensitivities *in vitro* to shrimp, squid and wheat. This could be the cross-reactivity which was already confirmed with the tolerance of an oral food challenge with shrimp, wheat, and the same foods prepared with uncontaminated flour. In patients with oral mite anaphylaxis, NSAID hypersensitivity has been observed in up to 40% of the patients. It has been included as one of the risk factors and the proposed criteria for diagnosis (Sanchez-Borges *et al.*, 2013; Sanchez-Borges & Fernandez-Caldas, 2015). Moreover, a case of dust mite ingestion-associated, exercise-induced anaphylaxis has been reported recently (Sompornrattanphan *et al.*, 2020).

Oral mite anaphylaxis is a rare condition. The prevalence is still unknown. It is identified as the immediate occurrence of severe allergic hypersensitivity after eating food contaminated with mites. New cases have been reported from various regions of the world. It is frequently reported mainly from the geographical areas with high temperature and humidity (Sanchez-Borges *et al.*, 2009; Sanchez-Borges *et al.*, 2013). Foods prepared with mite-contaminated wheat flour have been the most frequently implicated (Sanchez-Borges *et al.*, 2013). Many families of mites that have been demonstrated as triggers of oral allergic reactions such as families Pyroglyphidae (*D. farinae* and *D. pteronyssinus*), Glycyphagidae (*L. destructor*), Echimyopodidae (*B. tropicalis* and *B. freemani*), Acaridae (*A. ovatus*, *T. putrescentiae*, *T. entomophagus*), and Suidasiidae (*S. medanensis*) (Sanchez-Borges & Fernandez-Caldas, 2015, Masaki *et al.*, 2019).

D. farinae, the mite species identified in the contaminated flour, is a common mite found in the region of Southeast Asia and one

of the most abundant allergens in Thailand (Malainual *et al.*, 1995; Thomas, 2010). The name *farinae* comes from 'farina' in Latin and originates from the observation that this mite was found in flour. It is known to cause deterioration of the food products it is living in, for example, wheat flour, food grains, dried tea leaf, cereal, cheese, ham, chorizo, and salami. It was the most common cause of oral mite anaphylaxis in previous studies. Inoculation with one gram of *D. farinae* mites into six different common cooking flours in Thailand showed that room temperature (average 25–28°C) and a relative humidity of approximately 75% are the most suitable conditions for mite proliferation. The refrigerator condition could inhibit mite growth. Interestingly, it was demonstrated that the mites preferably proliferate in flour containing high wheat mixed with a baking powder such as our culprit flour (Gogi®) than in 100% wheat, corn, or tapioca flour (Suesirisawad *et al.*, 2015). Although most of the mite allergens are heat labile, Sanchez-Borges *et al.* (2012) also demonstrated a skin reaction to 100°C heated-contaminated wheat flour in a dust mite sensitive patients. It was suspected that heat-resistant 'Group 2 mite allergens' were responsible for this allergic reaction which appeared even in cooked mite-contaminated foods (Sanchez-Borges *et al.*, 2012, Sanchez-Borges & Fernandez-Caldas, 2015). A previous study showed that group 10 allergens (tropomyosins) is the cause of co-sensitization between dust mites, crustaceans, and some species of insects and mollusks. This may explain the positivity of specific IgE to shrimp and squid in the patient (Shafique *et al.*, 2012).

Oral mite anaphylaxis can be easily prevented. The most important measure is to prevent food especially cooking flour from being contaminated with mites (Sanchez-Borges & Fernandez-Caldas, 2015). The flour must not be stored under a hot and humid condition for long periods. It must be stored in a sealed clean glass or plastic containers in the refrigerator, once opened. The contaminated flour can look white and dry like normal, as the gross cannot be reliable (Masaki *et al.*, 2019). Oral mite anaphylaxis should be taken into consideration in a patient presenting with anaphylaxis after ingestion of food made with flour even if it has previously been tolerated.

The authors have no conflict of interest to disclose

The study was approved by the Research Ethics Committee of the Faculty of Medicine, Chiang Mai University Hospital, Chiang Mai University.

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