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# Food allergy preceded by contact urticaria due to the same food: Involvement of epicutaneous sensitization in food allergy



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AD atopic dermatitis  
 SPTs skin prick tests

## ABSTRACT

**Background:** There have recently been reports suggesting that sensitization to food allergens may occur outside the intestinal tract, especially through the skin. To clarify the role of epicutaneous sensitization in food allergy, we investigated the clinical characteristics of adult patients with food allergies preceded by contact urticaria due to the same foods.

**Methods:** We investigated clinical characteristics of 15 patients (20–51 years of age; 5 men and 10 women), who had food allergies preceded by contact urticaria.

**Results:** Fourteen patients were contact urticaria due to the causative foods during occupationally cooking, whereas 1 patient during face pack. In the occupational group, causative foods included rice, wheat, fruits, vegetables, fish, shrimp and cuttlefish; in the fresh cucumber paste case the cause was cucumber. In the 15 patients, the causative foods were fresh, not processed, and were tolerated by most (9/15, 60%) after heating. Regarding to symptoms after ingestion of the causative foods, the most frequently induced symptoms was oral symptoms (14/15, 93.3%), followed by urticaria (4/15, 26.7%), abdominal symptoms (3/15, 20%). The duration between the start of jobs or face pack, and the onset of contact urticaria was from 1 month to 19 years (mean, 8.7 years). The duration between the onset of contact urticaria and the onset of food allergy was from a few weeks to 6 years (mean, 11 months). One sushi cook experienced severe anaphylactic shock after ingestion of fish. In the occupational group, 13 of 15 patients (86.7%) had atopic dermatitis or hand eczema, indicating that the impaired skin barrier might be a risk for food allergies induced by epicutaneous sensitization.

**Conclusions:** Epicutaneous sensitization of foods could induce food allergy under occupational cooking and skin-care treatment with foods in adults.

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## Introduction

Food allergy has been classically thought to occur due to sensitization of food through the gastrointestinal tract. However, it has been hypothesized that sensitization to food antigen can occur even if the primary exposure to food allergens is through non-oral routes. This is largely due to the observation that some children have adverse reactions upon their first ingestion of allergens, suggesting that oral ingestion may not be the only means of sensitizing to an allergen.<sup>1</sup> One epidemiologic study also found that children with a positive food challenge to peanuts were more likely to have used creams containing peanut oil, raising the possibility that

skin exposure may be inducing sensitization.<sup>2</sup> Indeed, mice have been successfully sensitized to food allergens in an adjuvant-independent manner through epicutaneous routes.<sup>3–5</sup> Furthermore, nearly 2000 Japanese adults, who used a special facial soap (Chanoshizuku<sup>®</sup>) containing hydrolyzed wheat proteins (HWPs) developed allergic reactions after ingestion of wheat, indicating that epicutaneous sensitization to HWP in the soap might have induced wheat allergy.<sup>6</sup> These patients had shown no symptoms upon ingestion of wheat before use of the soap, suggesting that epicutaneous sensitization can occur even in individuals with established oral tolerance. According to the reports of the Special Committee for the Safety of Protein Hydrolysates in Cosmetics of the Japanese Society of Allergy (<http://jsall-web.sharepoint.com/Pages/report2.aspx>), most of these patients (60%) experienced contact urticaria due to HWP soap before the onset of food allergy due to wheat.

In the present study, we investigated the clinical characteristics of 15 adult patients in whom food allergy was preceded by contact

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urticaria due to the same food, suggesting that epicutaneous sensitization may have involved the allergy.

## Methods

### Patients

Outpatients, who had previously experienced localized immediate allergic reactions to foods, and thereafter developed allergic responses by ingesting them, were recruited into this study. Patients were all seen at the Department of Dermatology of Yokohama City University Hospital in the 7-year period between January 2004 and December 2011. Two of the patients, sensitized to fish and rice, were described previously.<sup>7,8</sup> Patients with positive results for specific IgE measurements, SPTs, and/or challenge tests with the suspected foods were diagnosed with “food allergies following epicutaneous sensitization”. After providing informed consent, participating patients underwent skin and blood tests to diagnose food allergies. This study was approved by our institutional review board.

### Laboratory tests

Serum total IgE and specific IgE levels (ImmunoCAP; Phadia, Uppsala, Sweden) for relevant foods were measured. The cutoff value of the assay was 0.7 kUA/l as class 2.

### Skin prick test

Patients were subjected to diagnostic skin prick tests (SPTs) using commercial extracts, such as wheat and rice (Torii, Tokyo, Japan) according to standard procedures.<sup>9</sup> In addition, fresh foods and

cooked foods that were suspected of inducing allergic reactions were also tested according to the prick-prick technique.<sup>10</sup> Histamine dihydrochloride at 10 mg/ml and phosphate-buffered saline served as positive and negative controls, respectively. The elicited response was considered positive when the average wheal diameter induced by the allergen extract was  $\geq 50\%$  of the positive control.<sup>9</sup> Prick-prick tests with all foods were also carried out on 5 control subjects.

## Results

### Clinical characteristics of patients

Fifteen patients (mean age, 31.1 years; range, 20–51 years; 5 men and 10 women;  $n = 15$ ) were diagnosed with food allergies following epicutaneous sensitization to foods (Table 1).

Epicutaneous exposure to food proteins in contact urticaria occurred as follows: cooks ( $n = 9$ , 60.0%) and housekeepers ( $n = 5$ , 33.3%) exposed to food as ingredients; an individual using foods to care for their skin, e.g., fresh cucumber paste face pack ( $n = 1$ , 0.7%) (Fig. 1). The face pack was applied after the skin was cleansed and scrubbed. These results indicated that the opportunity for contact urticaria due to foods could be divided into two groups: an occupational group, in which patients could be sensitized to foods via their skin during cooking and a fresh cucumber paste case, which could be sensitized to foods via its skin during skin-care treatments. (see Table 2).

### The causative foods of allergic symptoms

The foods that induced symptoms after ingestion included rice, wheat, fruits, vegetables, fish, shrimp, and cuttlefish in occupational

**Table 1**  
Clinical characteristics in patients of the occupational group and a fresh cucumber paste case.

Case No.	Age/sex	Opportunity for contact urticaria	Causative foods of food allergies	Duration		Symptoms after ingestion					Tolerability after heating foods	Other diseases	
				Between the start of jobs or face pack, and the onset of CU	Between the onset of CU and FA	OS	UR/AE		LT	AS			CO
						UR	AE						
1	20 F	Cook (Sushi)	Fish (horse mackerel, mackerel, salmon, amberjack, sole, conger)	1m	11m	+	+	-	+	+	-	-	AD, AR
2	26 F	Cook (Sushi)	Fish (salmon, horse mackerel, sardine, scallop)	1y	1y	+	+	-	+	+	+	-	AD
3	30 M	Cook	Lettuce, chicory	1y	1m	+	-	-	-	-	-	Unknown	None
4	35 M	Cook (Italian)	Wheat flour	9y	2m	+	-	-	-	-	-	+	AD
			Rice	14y	A few weeks	+	-	-	-	-	-	+	
			Lentils	19y	A few weeks	+	-	-	-	-	-	+	
5	22 F	Cook	Broccoli	2y	A few weeks	-	+	-	-	+	-	-	AD, AR
6	24 M	Cook	Fruits (orange, pineapple, kiwi)	5y	6m	+	-	-	-	-	-	+	HE
			Shrimp	5y	6m	+	-	-	-	-	-	-	
			Cuttlefish	5y	6m	+	-	-	-	-	-	-	
7	30 M	Cook	Vegetables (carrots, tomatoes)	5y	0m	+	-	-	-	-	-	+	AD, PO
8	30 M	Cook	Wheat flour	7y	9m	+	+	-	-	-	-	+	AD
9	39 F	Baker	Wheat flour	2y	6y	+	-	-	-	-	-	+	None
10	51 F	Housekeeper	Rice bran	3y	A few weeks	+	-	-	-	-	-	+	PO
11	33 F	Housekeeper	Vegetables (spinach, tomatoes, melons)	5y	A few weeks	+	-	-	-	-	-	+	HE, BA, PO
12	41 F	Housekeeper	Shrimp	10y	A few weeks	+	-	-	-	-	-	-	AD
13	40 F	Housekeeper	Grapes, cucumber	9y	A few weeks	+	-	-	-	-	-	+	AD, AR
14	44 F	Housekeeper	Carrots	7y	2y	+	-	-	-	-	-	+	AD, FA (wheat)
15	32 F	Face pack using fresh cucumber paste	Cucumber	5y	1y	+	-	-	-	-	-	Unknown	AD, PO

CU, contact urticaria; FA, food allergy; OS, oral symptoms; UR, urticaria; AE, Angioedema; LT, laryngeal tightness; AS, abdominal symptoms; CO, loss of consciousness; AD, atopic dermatitis; AR, allergic rhinitis; HE, hand eczema; FA, food allergy.

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