

Case Report



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Identification of a thermal stable allergen in yam (*Dioscorea opposita*) to cause anaphylaxis

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ABSTRACT

Yam (*Dioscorea opposita*) is commonly consumed in East Asia, but allergic reaction to this plant food is rare. To date, there is no report of anaphylactic reaction after ingestion of cooked yam. We described 3 cases with anaphylaxis after eating boiled yam and 1 present with oral allergy syndrome as well. Basophil activation test in patients showed positive reactivity to boiled yam extract. In immunoblotting, a 30-kDa protein was recognized by all patients' sera and a 17-kDa band was detected by 1 patient. N-terminal amino acid revealed the 30-kDa IgE reacted band was DB3S, dioscorin in *Dioscorea* tuber. It promoted us that DB3S was a thermal stable oral allergen to trigger anaphylactic reaction and oral allergy syndrome in cooked yam (*D. opposita*) allergy. Patients with this plant food allergy should avoid both raw and well-cooked yam.

Keywords: Anaphylaxis; DB3S; *Dioscorea opposita*; Thermal stable allergen; Yam

INTRODUCTION

Yam is the common name for the tuber of *Dioscorea opposita*. *D. opposita* belongs to the *Dioscoreaceae* family, *Dioscorea* genus. It is widely consumed in East Asia [1] and also serves as an important material medicine [2]. As a common food, it is usually cooked by boiling or steaming, but rarely eaten raw. Yam is mainly composed of carbohydrate, whereas it also contains 8% protein [3].

Allergic reaction to yam is rare in both clinics and literature. To our best knowledge, it has been only reported in patients with allergic symptom after inhaling or eating raw yam [4-8]. However, allergic reactions to cooked yam have never been published. Here, we represented 3 anaphylactic cases due to digestion boiled yam and detected the candidate allergen in cooked yam.

CASE REPORT

Three patients experienced anaphylaxis and oral allergy symptom (OAS) within 30 minutes after ingestion of boiled yam. All of them had a comorbidity of mugwort pollinosis. The detailed clinical data was summarized in **Table 1**. Considering of anaphylactic history, we did not perform skin prick test and double blind placebo control oral challenge test.

Table 1. Patients' information

Patients' No.	Sex	Age (yr)	Episodes of OAS	Episodes of anaphylaxis	Interval* (min)	Symptoms of anaphylaxis
1	Male	19	0	3	30	Generalized urticaria, chest tightness, dyspnea, hypotension, and collapse
2	Male	53	Several times	Several times	10	Tongue and laryngeal edema, itchy eyes and palms, labored breath
3	Male	43	0	1	15–20	Similar to patient 1

OAS, oral allergy symptom.

*Interval: time from ingestion of boiled yam to the onset of allergic reaction.

Basophil activation test was analyzed by the Flow CAST kit (BÜHLMANN, Schönenbuch, Switzerland). After signed an informed consent, 2-mL ethylenediaminetetraacetic acid anticoagulated peripheral blood and 2-mL sera were collected from 3 patients and 3 nonatopic adults. *D. opposita* (yam) was peeled, then boiled for 30 minutes and mashed, prepared in distilled water (1: 10 w/v) and collected the supernatant. According to the manufacture's protocol, after coincubation with whole peripheral blood and boiled yam extract (0.25, 0.50, and 0.75 mg/mL), CD63 expression on the surface of activated basophil was determined by flow cytometry. For food allergen, activation percentage $\geq 15\%$ was defined as positive. In patients 1, 2, and 3, 63.24%, 75.64%, and 24.07% of basophil were detected as activation (shown in Fig. 1A), whereas the controls' sera showed negative activation of basophil ($< 2\%$).

The boiled yam extract was separated by sodium dodecyl sulfate-polyacrylamide gel electrophoresis and more than 11 bands ranging from 10 to 130 kDa were observed. By the immunoblotting, a protein band with molecular mass around 30 kDa was recognized

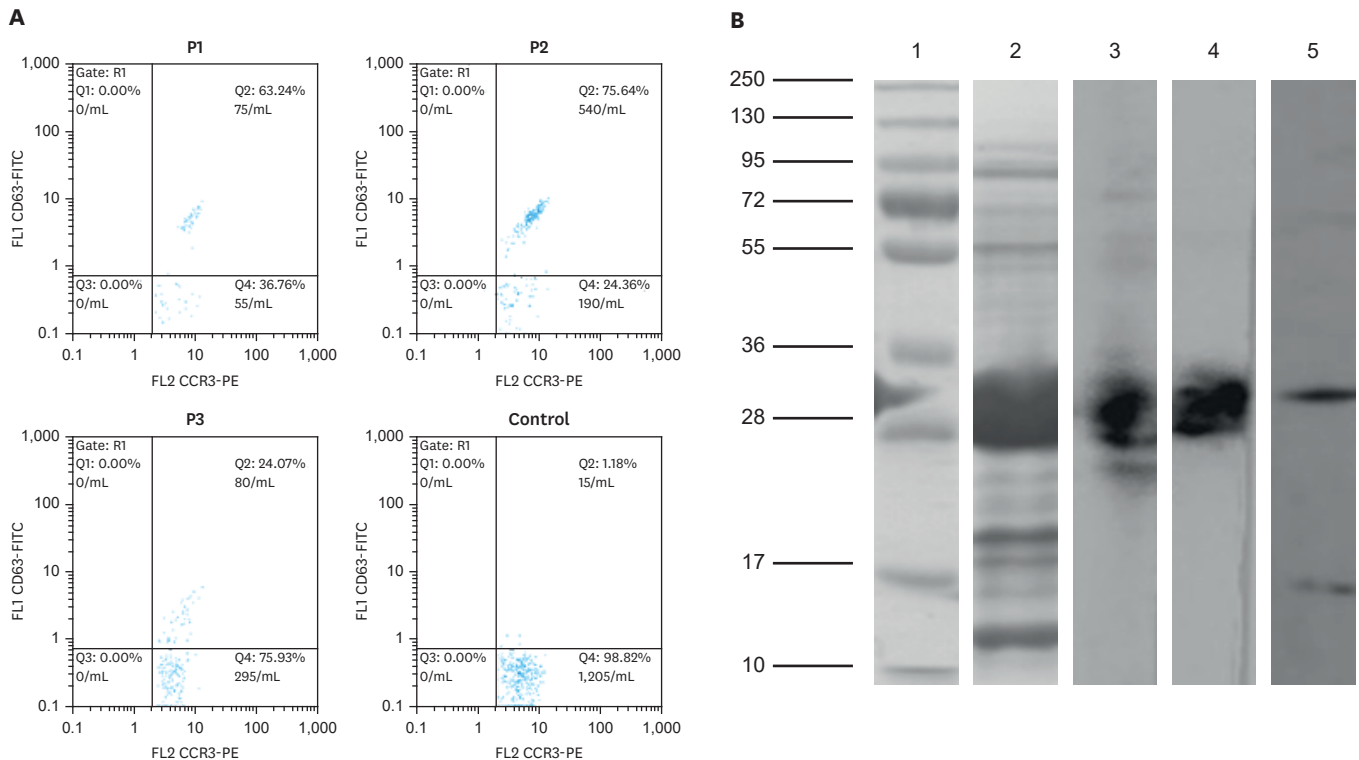


Fig. 1. (A) Basophil activation test. The rate of active basophil expressing CD63 in patients 1, 2, and 3 was 63.24%, 75.64%, and 24.07%. P1, 2, and 3: patient 1, 2 and 3. (B) Separation on 4%–12% sodium dodecyl sulfate-polyacrylamide gel electrophoresis and analysis of immunoblot. Lane 1 was protein marker. With Coomassie brilliant blue stain, more than 11 bands were observed in the total extract of boiled yam (lane 2). Immunoblot with sera from patients 1, 2, and 3 (lanes 3, 4, and 5) detected a 30-kDa IgE binding band. A 17-kDa protein was recognized by patient 3 (lane 5).

by all the patients' sera (Fig. 1B), but by none of the nonatopic controls. In addition, sera from patient 3 also reacted with a 17-kDa band. No immunoreactive bands were detected by controls' sera. The 13-base N-terminal amino acid of the 30-kDa protein band was identified as Val-Glu-Asp-Glu-Phe-Ser-Tyr-Ile-Glu-Gly-Asn-Pro-His. These amino acids displayed 100% identity with DB3S, tuber storage protein in *Dioscorea* tuber.

DISCUSSION

Previous cases have been published as being allergic to raw yam. For instance, a case manifested as occupational asthma and rhinitis following inhalation of yam [4], one developed urticaria and angioedema due to ingestion of fresh yam powder and the other presented with dyspnea after exposure to yam dust [8]. However, cooked yam has never been reported to cause allergic reactions. Here, we presented 3 anaphylactic cases due to boiled yam. In our patients, basophiles showed high reactivity to boiled yam extract, which confirmed the diagnosis. A 30-kDa IgE binding protein was determined by immunoblotting and identified as DB3S by N-terminal amino acid sequencing. DB3S is a 30.46-kDa nonglycoprotein and composed of 268 amino acid residues (UniProtKB - Q75N34). It is a kind of dioscorin, the main storage protein in *Dioscorea* tuber [9]. DB3S has been verified as inhaled and oral allergen in raw yam [4, 8]. Our study proved that it was also a thermal stable oral allergen in cooked yam and could precipitated OAS and anaphylaxis. Therefore, patients with yam allergy should be educated not to take ingestion of raw nor well-cooked yam.

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