

Catalase, a New Potential Allergen in Hypersensitivity to Avocado

Gómez-Fariñas C^{1,2}, Sánchez-Sánchez S³, Pineda de La Losa F⁴, López Rico MR¹, Parra Arrondo A¹, García-Paz V¹

¹Servicio de Alergología, Complejo Hospitalario Universitario de A Coruña, A Coruña, Spain

²Servicio de Alergología, Complejo Hospitalario Universitario de Vigo, Vigo, Spain

³Servicio de Alergología, Complejo Hospitalario Universitario de Ferrol, Ferrol, Spain

⁴Inmunotek SL, Alcalá de Henares, Spain

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Avocado (*Persea americana*), a tropical fruit from the Lauraceae family, has gained significant attention in recent decades owing to its health benefits [1,2]. While allergic reactions to avocado are well-documented, they are generally mild and associated with latex-fruit syndrome, which is driven primarily by chitinase (Pers a 1). However, hypersensitivity reactions outside this syndrome have also been reported, implicating additional proteins as potential allergens. These include profilin, polygalacturonase, glucanase, thaumatin-like protein, and isoflavone reductase-like protein [1].

We report the case of a 44-year-old Colombian woman with a history of severe seasonal allergic rhinitis (AR) triggered by grass-pollen. Thirty minutes after consuming a piece of fully ripe Hass avocado, she experienced pruritus, generalized hives, facial erythema, dyspnea, and 2 episodes of diarrhea requiring emergency medical attention. Of note, she had engaged in strenuous house cleaning 20 minutes before the reaction. She also reported oral and hand itching when consuming or handling oranges, tomatoes, mangoes, and papaya, although she tolerated other fruits and denied any symptoms related to latex exposure. The patient gave her informed consent for the publication of this case report.

The results of skin prick testing (SPT) with aeroallergens (*Dermatophagoides pteronyssinus*, *Lepidoglyphus destructor*, *Alternaria alternata*, *Aspergillus fumigatus*, dog and cat dander, *Phleum pratense*, *Cynodon dactylon*, *Plantago lanceolata*, *Cupressus arizonica*, *Betula alba*, *Platanus acerifolia*, *Parietaria judaica*, *Olea europaea*, profilin, Alt a 1), avocado, the nonspecific lipid transfer protein Pru p 3,

tropomyosin, and latex were positive for dog (5×5 mm), *P lanceolata* (10×10 mm), *C dactylon* (12×10 mm), *B alba* (8×8 mm), *P pratense* (12×10 mm), *P acerifolia* (8×6 mm), and profilin (10×10 mm). Prick-by-prick testing was performed with orange, avocado, tomato, papaya, and mango (pulp and skin) and yielded positive results with pulp. The results were positive for the pulp of orange (10×8 mm), avocado (12×12 mm), tomato (8×8 mm), papaya (12×12 mm), and mango (8×8 mm) and negative for the skin of these fruits. ImmunoCAP assay (Thermo Fisher Scientific) revealed the following results for IgE (kU/L): total, 25.60; avocado, negative; grass pollen, *P pratense*, 7.88; Phl p 1, 5.55; Phl p 5b, 6.73; Phl p 12, 0.24; *B alba*, 0.33; Bet v 1, 0.03; Bet v 2, 0.32; and *P lanceolata*, 0.59. The ISAC-multiplex-assay revealed the following results (ISU-E): *P pratense* (Phl p 1, 7.8; Phl p 5, 11; Phl p 12, 0.3), *C dactylon* (Cyn d 1), 1.1; *B alba* (Bet v 2), 0.4; latex (Hev b 8), 1; *Mercurialis annua* (Mer a 1), 1.1; and *P lanceolata* (Pla I 1), 1.2.

Western blotting was performed to evaluate serum reactivity to protein extracts from fully ripe avocado, tomato, and orange (peel, pulp, and juice). The analysis under reducing and nonreducing conditions revealed distinct IgE-binding patterns. In the avocado extract, IgE reactivity was observed for a prominent band at ~50 kDa under reducing conditions and a secondary band at ~15 kDa. In the case of the tomato extract, 3 IgE-reactive bands of between 35 and 50 kDa were observed under reducing conditions, while the orange extract consistently exhibited a 15-kDa band under both conditions, indicating a stable allergenic protein. A proteomic analysis of the 50-kDa band was performed. Proteins were extracted for peptide fingerprinting using a lysis buffer and sonication, quantified, reduced, and alkylated. After trypsin digestion, peptides were desalted, dried, and analyzed using LC-MS/MS in positive ion mode. The mass spectra were matched to theoretical fingerprints using the protein database (www.uniprot.org), identifying catalase as the allergen (score, 80; sequence coverage, 20%) (Figure). These findings suggest catalase as a potential novel allergen and highlight distinct protein reactivity profiles across the fruit extracts tested.

Although isolated hypersensitivity reactions to avocado are uncommon, a recent case reported allergy to endo-1,4 β-glucanase, with the patient experiencing otic and oropharyngeal pruritus [2]. In contrast, the case we report involved anaphylaxis, with multiorgan and systemic involvement.

The 15-kDa band identified in both avocado and orange extracts corresponds in molecular weight to profilin, which ranges between 12 and 16 kDa [3,4]. Profilin is 1 of 2 allergens listed in the Allergome database (http://www.allergome.org) for avocado (Pers a 4), alongside class 1 chitinase (Pers a 1). It is a thermolabile protein susceptible to pepsin digestion, typically associated with mild oral symptoms, although anaphylaxis can occur [3,4], often when cofactors such as physical exercise are involved. Profilin is a major allergen

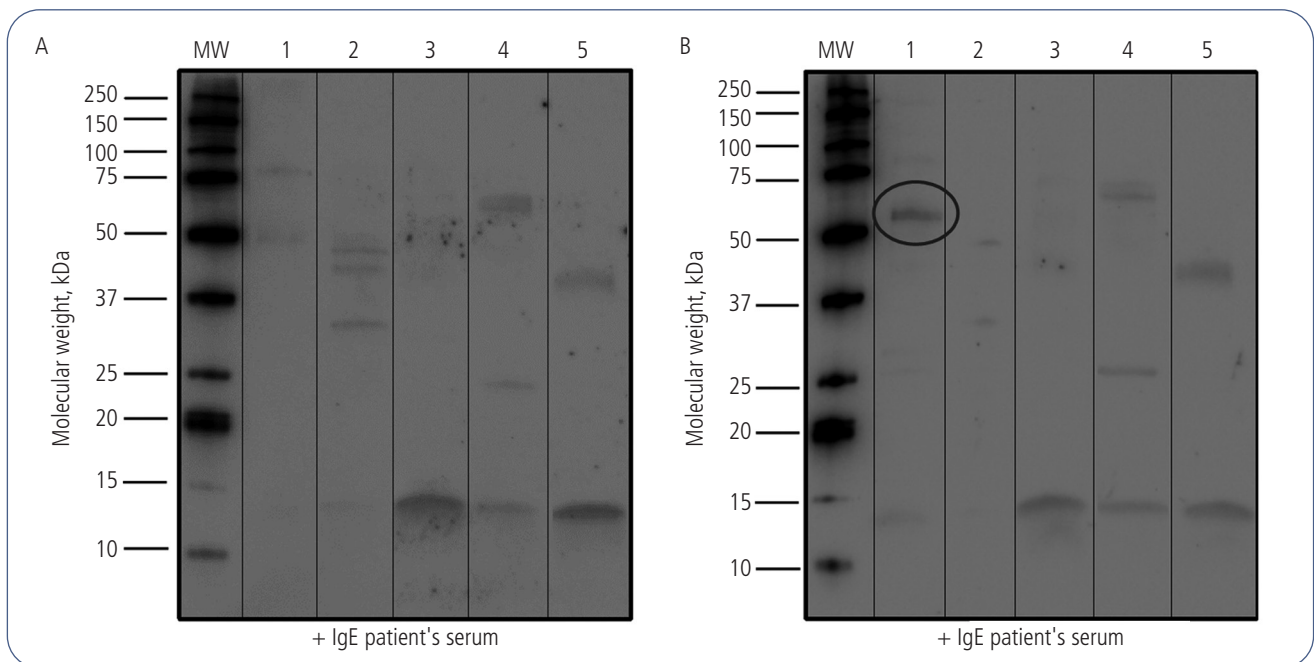


Figure. Western blotting results. IgE antibodies from the patient's serum under nonreducing conditions (A) and reducing conditions (B). The lanes show, from left to right, the molecular weight marker (MW), Hass avocado (lane 1), tomato (lane 2), orange peel (lane 3), orange pulp (lane 4), and orange juice (lane 5). The band corresponding to catalase is highlighted with a circle.

in fruits such as melon and orange and plays a key role in Pollen-Food Allergy Syndrome. This hypersensitivity reaction occurs in patients with seasonal AR, who become sensitized to pollen profilin through inhalation and later react to plant-derived foods [3,4].

Given her severe AR due to grass pollen, it is likely that the patient could have become sensitized via inhalation and subsequently reacted to avocado ingestion, with exercise acting as a cofactor. Anaphylaxis due to profilin has been documented in the literature [5,6], with some authors suggesting that profilin is a potentially severe food allergen and a marker of more persistent disease in patients with AR caused by grass pollen [7]. Furthermore, several authors have noted profilin's underrepresentation in commercially available allergen extracts [8], thus potentially explaining the negative or low levels detected in the patient's blood tests.

The involvement of another protein seems more likely owing to the patient's tolerance to plant foods commonly associated with hypersensitivity to profilin, such as watermelon and orange [4], where a band with the molecular weight of profilin was identified. The patient initially developed mild oral itching on intake of orange, although she now tolerates this fruit, thus making profilin an unlikely culprit. The prominent protein band of approximately 50 kDa in the avocado extract led us to consider the involvement of a protein other than profilin, namely, catalase, which was identified through proteomic analysis. Moreover, the number of anaphylactic reactions attributed to profilin in the literature is limited. Catalase is an antioxidant enzyme that is essential for plant cell growth and defense and plays a key role in cellular regulation [9]. To our knowledge, no cases of avocado allergy involving catalase have been reported. However, this protein has been identified as an allergen in other

foods, such as banana, where clinical manifestations range from mild oral symptoms to anaphylaxis [10]. The limited inclusion of catalase in standard diagnostic tools and the absence of comprehensive studies make its identification as an allergen challenging.

The intensity of the catalase band observed in the immunoblot, combined with evidence from Nikolić et al [10], who described a patient with hypersensitivity to catalase experiencing anaphylaxis, strongly suggests that catalase could be the primary trigger in the present case. This hypothesis is particularly plausible, given that profilin is rarely implicated in severe reactions, although its contribution cannot be completely ruled out.

Our study is the first to identify catalase as a protein in avocado. We propose that catalase should be recognized as a potential allergen in avocado, particularly in severe reactions such as anaphylaxis.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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Carolina Gómez Fariñas

Servicio de Alergología
Hospital Meixoeiro
Complejo Hospitalario Universitario de Vigo
Estrada do Meixoeiro, s/n
36214 Vigo (Pontevedra), Spain
E-mail: carolina.gomez.farinhas@sergas.es