



Lipid transfer proteins and thaumatins as relevant allergens in melon peel allergy

Melon (*Cucumis melo*) belongs to the Cucurbitaceae family and is one of the most frequently involved fruits in allergic reactions. Oral allergy syndrome after ingestion of pulp is the main manifestation; systemic reactions are rare.¹ Several allergens have been identified in pulp, as follows: cucumisin (Cuc m 1),² profilin (Cuc m 2),³ pathogenesis-related protein (PR) of the PR-1 family (Cuc m 3),⁴ malate dehydrogenase,⁵ and phloem lectin (Lec 17-1). We report a patient with allergic symptoms after ingestion of melon pulp and after contact with melon peel.

A 15-year-old girl experienced oral pruritus and labial angioedema while eating melon. She also presented palpebral angioedema and conjunctivitis in the eye she touched after physical contact with melon peel. She had presented labial angioedema immediately after eating an omelet made of peeled zucchini, although she subsequently tolerated eggs and other Cucurbitaceae (peel and pulp of water melon, cucumber, and pumpkin). Parental consent was provided for an allergy workup.

The results of skin prick tests with commercial extracts of melon, palm profilin, and lipid transfer protein (LTP) of peach (Pru p 3) were negative. Skin prick tests with standardized extracts of common aeroallergens (ALK-Abelló S.A., Madrid, Spain) were positive (wheal, >3 mm) for pollens (grass and *Olea europaea*). Prick-by-prick testing with melon was positive for pulp (5 mm) and very positive for peel (30 mm). The results of prick-by-prick testing to other Cucurbitaceae peels were slightly positive (watermelon, cucumber, and pumpkin), even though the patient had always tolerated them. Of the pulps tested, only that of zucchini gave a positive result. Serum specific immunoglobulin E (IgE) was positive to cucumber (1.22 kU_A/L) but not to melon. Total IgE was 62.8 IU/mL. The melon peel extract was manufactured by homogenization in phosphate-buffered saline, dialysis, and lyophilization. Sodium dodecyl sulfate polyacrylamide gel electrophoresis IgE-immunoblotting assay with this extract revealed IgE reactivity bands of 7 to 8 kDa and 28 to 29 kDa (Fig 1). To identify these IgE-binding proteins, both bands from the melon peel extract were manually excised from the gel, digested with trypsin, and analyzed using matrix-assisted laser desorption/ionization-time of flight and liquid chromatography electrospray ionization tandem mass spectrometry following the methodology of Pastor et al.⁶ Proteins were identified by searching a nonredundant protein sequence database (NCBI) using the Mascot program (<http://www.matrixscience.com>). We performed MS/MS and obtained 2 sequences of internal peptides: SLNQAATTADRR for the 7- to 8-kDa protein (M2) and SGPGQPQLSTGTGFELAR-SFTVPAPWTGR for the 28- to 29-kDa protein (M1). Research conducted with protein databases identified the first sequence as an LTP and the second as the thaumatin-like protein from *Cucumis melo* (Gi: 38606865). To confirm the absence of cross-reactiv-

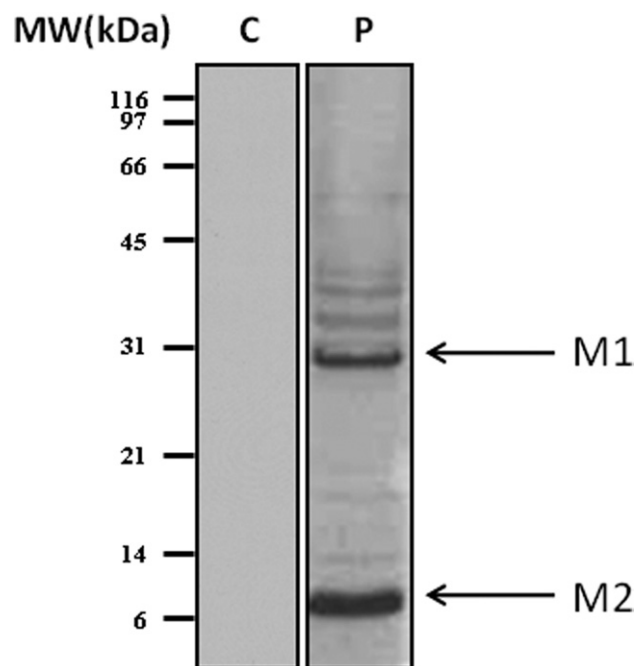


Fig. 1. Identification of allergens in melon peel extract. Sodium dodecyl sulfate polyacrylamide gel electrophoresis immunoblotting with melon peel extract in solid phase. Lane P: Incubated with patient serum; Lane C: Incubated with control serum (pool of sera from nonatopic subjects). Abbreviation: MW, molecular weight marker in kDa.

ity between LTP from melon and peach, the patient's serum was pre-incubated with peach extract. Immunoblotting inhibition assays were performed after incubation of 1 mL of serum with 100 μ g of melon peel or peach peel extract at room temperature for 4 hours with constant stirring. IgE binding was not inhibited in the serum with the peach peel extract, although it was totally inhibited in the serum with the melon peel extract. In addition, immunoblotting assay using anti-Pru p 3 in melon peel extract did not recognize any bands. Immunoblotting with melon pulp to determine whether these new LTPs and thaumatin were also present did not reveal IgE-binding bands (polyclonal anti-Pru p 3 was donated by Dr. Díaz-Perales; UPM-INIA, Madrid, Spain). Previous tests with polyclonal antibodies showed extremely small amounts of protein (nanograms) in immunoblotting assays. Therefore, the lack of IgE binding was probably attributable to the absence of these proteins in the pulp extract.

The LTPs, which belong to the PR-14 family, are very highly conserved and have a molecular weight of approximately 9 kDa. They are usually involved in systemic allergic reactions caused by

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vegetables, fruits (eg, Rosaceae), nuts, cereals, latex, and pollens. Although cross-reactivity has been described within the LTP family, homology between LTP sequences from botanically unrelated vegetable foods varies from 35% to 95%.⁷ Consistent with our findings, some nonspecific LTPs do not cross-react with Pru p 3.⁸ Thaumatinins are very stable proteins belonging to the PR-5 family. They have a molecular weight of approximately 23 kDa and are involved in systemic allergic reactions to fruits, vegetables, and pollens.

Allergy to melon pulp has been reported in patients with pollinosis who are sensitized to profilin,¹ although no data exist for allergy to melon peel. We present a case of IgE-mediated contact angioedema to melon peel involving an LTP and a thaumatin-like protein precursor (*Cucumis melo*) as relevant allergens. The absence or scarce presence of these proteins in pulp could explain why we were unable to find them. Although allergic reactions to melon are usually attributed to pulp allergens, we should also take into account the allergens present in peel.

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