

Comprehensive analysis of Mal d 1 mRNA in apples cultivated in Japan

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Abstract

Pollen food allergy syndrome (PFAS) is class 2 food allergy. There are many patients with *Betulaceae* pollen allergy who concomitantly develop apple PFAS in Japan and Europe. Varietal differences in allergen components have been clarified in Europe. However, most cultivars are not common between Europe and Japan, and there is no information for allergens of varieties cultivated in Japan, excluding several varieties cultivated overseas such as Fuji. With this background, we compared the mRNA levels of Mal d 1, which are high among the main allergen components of apple PFAS, Mal d 1, using apple varieties cultivated in Japan, especially in Nagano Prefecture. Using 28 varieties of apples produced in Nagano Prefecture as samples, relative quantification of mRNA was performed using real-time PCR. Compared with that in Sun fuji, the Mal d 1.01 mRNA expression level was significantly lower in 18 varieties, including Aika no kaori, whereas it was significantly higher in Koutoku. The Mal d 1.02 mRNA expression level was significantly lower in 6 varieties, including Shinano dolce, and significantly higher in 10 varieties, including Shinano red. This is the first study to conduct a quantitative analysis of Mal d 1 mRNA expression levels in Japanese apple cultivars and the data will help dietary advice for apple PFAS patients.

Keywords : Mal d 1, PFAS, Real-time PCR, Japanese apple cultivar, Allergen component

I Introduction

Oral allergy syndrome (OAS) is a class 2 food allergy in which a feeling of stimulation and itching in the oral, pharyngeal, and labial mucosae develop within 15 minutes of food making contact with the oral mucosa. Symptoms are localized to the oral cavity and spontaneously regress over time in many cases; however, edema and blisters may concomitantly develop. In rare cases, symptoms are not limited to the oral cavity and urticaria, rhinitis symptoms, respiratory symptoms, including the sensation of a laryngeal obstruction, digestive symptoms, such as diarrhea and abdominal pain, and anaphylactic shock may potentially develop^{1, 2)}. OAS induced by sensitization with pollen is termed Pollen Food Allergy Syndrome (PFAS)²⁾. Pollen Food Allergy Syndrome (PFAS) is an allergic disease caused by the cross-reaction of pollen-specific IgE with vegetable and fruit antigens^{1, 2)}. PFAS is

induced by the oral ingestion of food containing antigens that cross-react with sensitizing antigens after the establishment of inhalation sensitization by pollen. Accordingly, PFAS concomitantly develops with several types of pollinosis. PFAS induced by celery or mango accompanying ragweed pollinosis and that caused by melon, watermelon, orange, kiwifruit, or tomato accompanying grass pollinosis have been reported, and the most common PFAS is induced by Rosaceae fruits, such as apples, peaches, and cherries, in birch pollen allergy patients³⁾. Birch pollen allergy is accompanied by apple PFAS in many patients in Hokkaido, Japan and Central to Northern Europe, with 70-80% of birch pollen allergy patients in Hokkaido also having apple PFAS^{4, 5)}. Recent studies reported patients with apple PFAS accompanying *Alnus* pollinosis in Honshu^{6, 7)}. Regarding the distribution of birch family plants in Japan, *Alnus alder* grows in wetlands and marshy ground throughout Japan. *A. sieboldiana* Matsumura is a deciduous tree that was previously

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Abbreviations Used: OAS, Oral allergy syndrome; PFAS, Pollen food allergy syndrome; GD, Golden delicious; PR-10, Pathogenesis-related protein -10; ELISA, Enzyme -linked immunosorbent assay.