

# Insights into pediatric pollen food allergy syndrome

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Pollen food allergy syndrome (PFAS), previously known as oral allergy syndrome, is an immunoglobulin E–mediated food allergy caused by cross-reactivity between pollen and plants allergens. Patients with pollen allergies may react to fruits, vegetables, and/or tree nuts that share epitopes of prior sensitized allergenic pollen.<sup>1)</sup>

The prevalence of PFAS is difficult to estimate for several reasons, including a lack of awareness of patients and physicians. Since the prevalence of pollinosis has increased with climate change,<sup>2)</sup> the incidence of PFAS is also expected to increase.

Little is known about PFAS prevalence by age. Among British children with seasonal allergic rhinitis (AR), the prevalence of PFAS was reportedly 17% and 78% in those under 5 and older than 10 years, respectively.<sup>3)</sup> This large difference may be due to the high likelihood of eating more cross-reacting fruits, vegetables, or nuts and a higher awareness of symptoms after 5 years of age. Recent study showed no age-based difference in PFAS frequency among patients with pollen allergies except those under 5 or over 60 years of age.<sup>4)</sup>

The incidence of PFAS in children from some countries was reported as 9%–43%, depending on the geographical distribution of types of pollen and the characteristics of study subjects (Table 1).<sup>3–8)</sup>

The prevalence of AR in Korean children is reportedly 21%; of them, 37.0% showed pollen sensitization.<sup>9)</sup> The PFAS prevalence is 42.7% among Korean children with pollinosis.<sup>4)</sup> This incidence in hospital-based patients may be higher than those of

general population. With those data, the estimated prevalence of PFAS would be 4.3%.

In contrast to class 1 food allergens, which induce sensitization via the gastrointestinal tract, are stable to heat, acid, and digestive enzymes, and are usually responsible for systemic reactions, class 2 food allergens are highly cross-reactive to pollen sensitized through the respiratory route and generally unstable and degraded easily by heat and digestive enzymes. Symptoms of PFAS include pruritus, paresthesia, and angioedema of the lips, oral mucosa, tongue, and palate. However, other cutaneous, respiratory, gastrointestinal, neurologic, and cardiovascular symptoms and even anaphylaxis may occur at an incidence of 1.9%–10%.<sup>4)</sup> In the current issue, Jeon<sup>10)</sup> reviewed various PFAS symptoms and their frequencies. Since the highly cross-reacting molecules causing PFAS are ubiquitous, they are classified as panallergens. Jeon<sup>10)</sup> also summarized pollens and their cross-reactive allergens of food according to the panallergen family of pathogenesis-related protein (PR) 10, profilin, and PR-14 (lipid transfer protein). Bet v 1 homologues belong to PR-10, which is heat-labile, causes mild oral symptoms, and accounts for most of the clinical cross-reactivity between birch pollen and Rosaceae fruits (e.g., apple, pear, plum), Apiaceae vegetables (e.g., celery, carrot), Betulaceae (hazelnut), and Fabaceae (soybean). Jeon<sup>10)</sup> also emphasized that Api g 1 of celery and Gly m 4 of soybean can cause systemic symptoms despite of belonging to PR-10.

Clinical manifestations can vary among sensitized pollen types and implicated food allergens from mild oral symptoms

**Table 1. Prevalence of pediatric pollen food allergy syndrome**

Country	Subjects, numbers	Age (yr)	Prevalence (%)	frequently Implicated fruit	Implicated pollen	Comments
Italy <sup>5)</sup>	Seasonal AR, 1360	4–18	24	Kiwi	Timothy grass	
Australia <sup>6)</sup>	AR with pollen sensitization, 66	4–17	12	Watermelon	Perennial rye grass	Sydney region
Britain <sup>3)</sup>	Seasonal AR, 54	<5	17	Hazelnut, apple, kiwi	Birch	
		5–10	50			
		>10	78			
Mexico <sup>7)</sup>	Seasonal AR, 267	6–14	8.9	Pine apple	Oak	
Korea <sup>4)</sup>	Pollen allergy, 648	≤18	42.7	Peach, apple	Birch, alder, oak	
Korea <sup>8)</sup>	AD with birch sensitization, 186	2–6	36.6	Kiwi, apple	Birch	
		7–18	50.5			

AR, allergic rhinitis; AD, atopic dermatitis

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to systemic reactions including anaphylaxis. Patients with PFAS reacting to the same food may have different sensitization profiles that result in different responses to food. For example, in birch pollen-related apple allergy, the major allergen is Mal d 1, which causes mild reactions due to cross-reaction to Bet v 1 (PR-10). However, in mugwort pollen-related apple allergy, Mal d 3, the major allergen, cross-reacts with Art v 3, a lipid transfer protein, which is relatively stable to heat and digestion and may contribute to a systemic reaction.<sup>11)</sup> In addition, not all fruit/vegetable allergies are caused by class 2 allergies. In a European study, apple allergies in the Netherlands, Austria, and Italy were mild and related to birch pollinosis and sensitization to Bet v 1 and its apple homologue. In contrast, in Spain, apple allergies were severe and not related to pollen, but to peach allergy caused by cross reaction between Pru p 3 in a peach and Mal d 3 in an apple.<sup>12)</sup> Thus, patients with a class 1 food allergy could be diagnosed with PFAS, which may lead to suboptimal treatment of potentially life-threatening food allergies.

In conclusion, although the true prevalence of PFAS is difficult to determine in the general pediatric population, it affects a significant proportion of children. Thus, a more detailed medical history is needed to diagnose PFAS in children. Children who are unwilling to eat fruits, vegetables, and/or nuts or have food-associated oropharyngeal symptoms should be evaluated for PFAS. Although many aspects of PFAS remain poorly understood because of great heterogeneity in its causes, risk factors, natural history, comorbidities, and treatment responses, physicians are expected to properly categorize patients and provide appropriate guidance upon understanding the prevalent allergenic pollen and cross-reactive foods by geographical region.

#### Conflicts of interest

No potential conflict of interest relevant to this article was reported.

See the article “Pollen-food allergy syndrome in children” via <https://doi.org/10.3345/cep.2019.00780>.

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