

Case Report



A paediatric case of exercise-augmented anaphylaxis following bee pollen ingestion in Western Australia

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Conflict of Interest

The authors have no financial conflicts of interest.

ABSTRACT

Bee pollen is becoming an increasingly popular health supplement worldwide due to its many therapeutic applications. Thirteen cases of anaphylaxis to bee pollen consumption have been published to date, with plant pollen of the Compositae family being the most frequently implicated allergen. We present the first known paediatric case of bee pollen anaphylaxis in Australia involving a 15-year-old boy who had a strongly positive skin prick test to the bee pollen consumed where exercise was a possible co-factor. Our patient had a history of allergic rhinitis like most earlier cases. Our patient also had a strongly positive skin prick test to overseas-sourced bee pollen despite no relevant travel history, indicating the likelihood of a common pollen grain or cross-allergenicity of pollen grains found within both bee pollens. Our case reinforces the importance of a careful dietary history including health supplements when assessing for anaphylaxis.

Keywords: Bee pollen; Pollen; Anaphylaxis; Allergy; Allergic reaction; Exercise

INTRODUCTION

Bee pollen is becoming an increasingly popular health supplement worldwide due to its many therapeutic applications. Thirteen cases of bee pollen anaphylaxis [1-11] have been reported to date, with plant pollen of the Compositae family being the most commonly implicated allergen. We present the first known case report of anaphylaxis to bee pollen in Australia.

CASE REPORT

A 15-year-old boy with a preceding history of seasonal allergic rhinitis develops generalised urticaria, facial angioedema and dyspnoea 30 minutes into a vigorous group exercise class. He ate breakfast an hour prior that comprised of bee pollen granules, mixed nuts (almond, cashew, hazelnut, walnut, pecan), 5 grain porridge (rolled barley, oats, rye, triticale, brown rice), and mixed seeds (teff, chia, linseed, sunflower, pumpkin, flaxseed). The bee pollen was purchased from a local market.

Author Contributions

Conceptualization: Meera Thalayasingam, Michael O'Sullivan. Formal analysis: Zhi Xiang Leang. Investigation: Meera Thalayasingam, Michael O'Sullivan, Zhi Xiang Leang. Methodology: Meera Thalayasingam, Michael O'Sullivan. Project administration: Zhi Xiang Leang. Writing - original draft: Zhi Xiang Leang. Writing - review & editing: Zhi Xiang Leang, Meera Thalayasingam, Michael O'Sullivan.

Table 1. First and second skin prick test results

Skin prick test	Results (mm)	Allergen(s)	Results (mm)
First skin prick test			
Allergen(s)			
<i>Dermatophagoides pteronyssinus</i>	10×9	Bee pollen	15×18
<i>Dermatophagoides farinae</i>	19×10	Eucalyptus	7×5
Bahia	3×3	Olive	Negative
Bermuda	3×3	Birch	7×5
Johnson	3×5	Cat pelt	3×3
Flax seed	Negative	Dog	Negative
Chia		Alternaria	
Pumpkin seed		Wheat (grain mix)	
Sunflower seed			
Linseed			
Teff flour			
Second skin prick test			
Allergen(s)			
Local bee pollen	5×7	American bee pollen	15×10

He was well before the reaction and took no medications. He was treated with intravenous hydrocortisone and intramuscular adrenaline by his general practitioner and observed in hospital before being discharged without intervention.

He was assessed in our Paediatric Immunology clinic 3 months after the reaction. He recalled experiencing abdominal cramps within minutes of consuming bee pollen on 3 previous occasions but never reacted to any other food or exercise. Since his severe allergic reaction, he has eaten the mixed nuts, 5 grain porridge, and bread and exercised without symptoms. He continued to avoid the mixed seeds and bee pollen granules.

The patient underwent skin prick testing to a range of commercial extracts and fresh ingredients which included bee pollen granules he consumed (**Table 1**). Our nurse was also skin pricked with the same bee pollen and tested negative. Specific IgE testing was negative to wheat, omega-5 gliadin, bee venom and honey. He was advised to avoid bee pollen granules lifelong and reintroduce the mixed seeds at home due to his negative skin prick results to the mixed seeds.

The patient returned 2 years later for skin prick testing to bee pollen that we purchased from the United States (US) and the original bee pollen. The test results are shown in **Table 1**. As he had yet to reintroduce the mixed seeds at home, he was offered a supervised oral challenge at our hospital but declined.

Informed consent was obtained from the patient's parents prior to the writing of this case report. Ethics approval was not required following discussion with the Human Research Ethics Committee of the South Metropolitan Health Service.

DISCUSSION

To the best of our knowledge, our patient is the first case of bee pollen anaphylaxis to be reported in Australia. **Table 2** summarises the 13 cases published on bee pollen anaphylaxis to date.

Table 2. Published cases of systemic allergic reaction to bee pollen

Case	Age/sex	Symptoms and signs of reaction	Allergic rhinitis	Pollen sensitisation	Bee pollen composition	Country
1	31/F	FA, U, D	Yes	Rw, Dd	LP, Dd	US [1]
2	27/F	FA, GU	Yes	Rw, Dd	Dd	US [1]
3	25/M	FA, GU, C, H	Yes	Rw, Dd	Dd	US [1]
4	46/M	S, GU, A, D, H	Yes	Mesquite	Mesquite	US [2]
5	49/F	FA, V, R, I, D	Yes	Ch, GR, As, Rw, Mw, Dd	GR, ST, LP	SK [3]
6	33/M	NS, TT, D	N/A	N/A	N/A	US [4]
7	32/M	GU, FA, D, HV	Yes	Mw, Dd, Wi	Dd, Mw, Wi, O, fungi	Spain [5]
8	56/F	GU, I, TT, D	Yes	Elm, BG, OG, Rw	RW, Hs, PS, vetch	US [6]
9	54/F	GU, FA, D, H	Yes	Mw, Rw, Dd	Mw, Rw	SK [7]
10	30/F	FA, U, D, DZ	Yes	TG	N/A	Canada [8]
11	35/M	LA, N, cough, W, CT, DZ, H	Yes	Dd, Ch	Dd, Ch	Malaysia [9]
12	40/M	GU, FA, D, N, V, AP, Di, W, H	Yes	Mw, Rw, Ch, Dd	Japanese hop, Ch, Rw, Dd	SK [10]
13	40/M	NC, D, U, A	Yes	BW, Co, ME, Rw	N/A	US [11]

A, angioedema; AP, abdominal pain; As, aster; BG, blue grass; BW, black willow; C, convulsions; Ch, chrysanthemum; Co, cocklebur; CT, chest tightness; D, dyspnoea; Dd, dandelion; Di, diarrhoea; DZ, dizziness; F, female; FA, facial angioedema; GR, golden rod; GU, generalised urticaria; H, hypotension; Hs, honeysuckle; HV, hoarse voice; I, itch; LA, lip angioedema; LP, legume pollen; M, male; ME, marsh elder; Mw, mugwort; N, nausea; N/A, not available; NC, nasal congestion; NS, neck swelling; O, other flower pollens; OG, orchard grass; PS, privet shrub; R, rhinorrhoea; Rw, ragweed; S, sneezing; SK, South Korea; ST, sow thistle; TG, timothy grass; TT, throat tightness; U, urticaria; US, United States; V, vomiting; W, wheeze; Wi, willow.

Adapted from Choi et al. *Allergy Asthma Immunol Res* 2015;7:513-7 [10].

Although the diagnosis of bee pollen anaphylaxis would be further strengthened by a successful oral challenge to mixed seeds, the patient's preceding history of isolated gastrointestinal symptoms following bee pollen ingestion (on 3 occasions), strongly positive skin prick result to bee pollen and negative skin prick result to the mixed seeds makes the diagnosis very likely. Exercise was likely a co-factor due to the reaction occurring during exercise. It is also possible for exercise to be coincidental as the reaction occurred within an hour of bee pollen ingestion. A differential diagnosis of food-dependent exercise induced anaphylaxis was considered but not pursued by means of provocation testing with sequential food and combined food-exercise challenges as the patient was agreeable to avoiding bee pollen lifelong.

Bee pollen is a food source for worker bees composed predominantly of pollen grains and nectar, in addition to bee salivary secretions, honey and beeswax [12]. It may contain fungal spores and other bee body components [12]. Despite its heterogenous composition, the pollen grain component has been consistently identified as the allergen behind these reactions. Six of the 13 published cases [1, 6, 9, 10] demonstrated cross-allergenicity between the ingested bee pollen and plant pollen using enzyme-linked immunosorbent inhibition assays, whereas another 4 cases [2, 3, 5, 7] confirmed sensitisation to plant pollen present within the ingested bee pollen using skin prick or serum specific IgE testing.

Our patient reported a history of allergic rhinitis like most published cases. In cases where wind-pollinated pollens were detected within ingested bee pollen [2, 5-7, 10], prior sensitisation to these pollens could account for allergic reactions to bee pollen. In cases involving only insect-pollinated pollen [1, 3, 9], the patients showed sensitisation to both wind and insect-pollinated pollens, indicating cross-allergenicity as the causative mechanism.

All published cases to date implicate pollen from the Compositae family as the causative allergen. In our patient's case, Eucalyptus pollen was suspected to be the causative allergen as the bee pollen he ingested was sourced locally from Eucalyptus-rich forests of Dandaragan, Pinjarra, or Moora in Western Australia and he had proven sensitisation to Eucalyptus on skin prick testing. He was therefore skin prick tested again to test this hypothesis with the expectation that he would have a much larger skin reaction to the bee pollen he consumed

than the one sourced from the US. Surprisingly, the opposite result was observed despite the patient having never travelled to the US. Possible explanations for the result include sensitisation to more than one pollen grain in an atopic patient, cross-allergenicity between pollen grains or sensitisation to an alternative pollen grain (not Eucalyptus) found within both bee pollens. For the latter to be possible, the same plant species would need to be present in both countries.

Interestingly, our patient continued to tolerate honey despite being anaphylactic to bee pollen. While it is theoretically possible for cross-sensitisation to occur to other bee products due to similarities in composition [13], no cases have been reported to date of bee pollen allergic patients developing allergic reactions to other bee products.

In conclusion, this is the first known reported case of anaphylaxis to bee pollen associated with exercise in Australia. A careful dietary history including health supplements should be obtained when assessing for anaphylaxis. There is insufficient evidence to date to advise bee pollen allergic patients to avoid other bee products or bee stings.

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