

Clinical Communications

Anaphylaxis and allergy to coconut: An Australian pediatric case series

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Clinical Implications

- We report 9 cases of anaphylaxis and 26 cases of allergy to coconut in the largest clinical series examining this rare allergen. Having a tree nut allergy was not associated with increased incidence of coconut allergy, and eczema was common.

Coconut (*Cocos nucifera*) is a drupe (or stone fruit), not a nut, that patients and families managing tree nut allergies may be concerned about. This may be reinforced by regulatory decisions to group coconut with tree nuts for allergen declaration purposes (as is the case in the United States, for example, but not Australia). Few case reports of coconut allergy exist in the literature to assist clinicians.¹⁻⁴ We report the largest case series of coconut anaphylaxis (9 cases) and less severe IgE-mediated allergy (26 cases) to date, derived from more than 5000 patients reviewed for food allergy by clinicians in the Department of Allergy and Immunology at the Children's Hospital at Westmead (a tertiary referral center) over 30 months (June 2017 through December 2019). Data were obtained by retrospective chart review, initially searching for the word "coconut." Individual manual analysis of charts including the word "coconut" was then performed. Patients were included in the case series if they had a history consistent with an immediate reaction after ingestion of coconut and a skin prick test wheal of at least 3 mm greater than that achieved with the negative control to coconut extract (ALK, Hørsholm, Denmark) and/or fresh/desiccated coconut. No cases were identified where the diagnosis was contentious. Cases were classified as either anaphylaxis or less severe IgE-mediated allergy, based on consensus criteria.⁵ Statistical analysis was undertaken using GraphPad Prism version 8.4 (La Jolla, Calif).

Salient clinical characteristics of the 9 cases of coconut anaphylaxis are summarized in Table I. Patient 1 had the youngest age of first reaction, at 10 months. Among multiple episodes of anaphylaxis, she notably reacted to coconut milk—containing vapors after spending 10 minutes in an unventilated space where a curry was being prepared. The reaction consisted of coughing, wheeze, respiratory distress, and angioedema, followed by lethargy and unresponsiveness. Paramedics noted rapid improvement following the administration of intramuscular adrenaline (epinephrine). Patient 6 had a severe episode of anaphylaxis, requiring 2 doses of adrenaline (epinephrine), at age 18 months to baked coconut. He maintains his allergy at age 8 years. Patient 7 had his first episode of anaphylaxis at age 2.5 years and maintains his allergy at 11 years, having also developed eosinophilic esophagitis. Patient 8 is now

13 years old and his coconut skin prick test result is now negative; he is awaiting a medically supervised coconut challenge. The first reaction of patient 9 was at a comparatively late age (12 years) compared with the rest of the anaphylaxis cohort; skin prick testing demonstrated a 17-mm wheal. The family of patient 4 arranged for laboratory testing to confirm absence of dairy from a coconut yogurt product that had precipitated anaphylaxis, because this child had already been diagnosed with cow's milk allergy. Suspicion of cow's milk contamination of coconut products is salient in view of a previous Australian case of fatal anaphylaxis following inadvertent milk ingestion via an incorrectly labeled coconut drink.⁷

Table II compares clinical features of patients with and without anaphylaxis. Patients with anaphylaxis showed a trend toward younger age at first reaction (2.73 vs 4.57 years, $P > .05$) and had a significantly larger skin prick test wheal at diagnosis (9.3 mm vs 5.4 mm; $P < .01$). Egg, milk, and peanut were the most common concomitant allergens; the high prevalence of egg and milk allergy likely reflects the age distribution of our cohort, with only 1 patient with anaphylaxis having the first reaction after the age of 3 years. Eczema was present in 74% of the whole cohort. During routine eczema management, at least 6 patients from our case series disclosed use of coconut-based skincare products before their index reaction to coconut, though these data were not recorded in chart notes for most patients. Sensitization via transcutaneous exposure has been implicated in food allergies,⁸ and our limited data reinforce concerns that the application of food proteins to the skin (before tolerated ingestion) is not without risk, particularly when the skin barrier is compromised. Potential examples of sensitization arising in this manner are patients 2 and 3 in our anaphylaxis cohort, who reacted upon their first known ingestion of coconut, which took place months after coconut oil had been applied topically to treat eczema. Even more concerning, Anagnostou⁹ reported coconut anaphylaxis in a patient previously tolerant to ingested coconut and with a long history of topical coconut oil application. Systematic inquiry into the use of coconut-containing skincare products in the coconut-allergic population, compared with the general food-allergic population, would be valuable in providing evidence-based advice in this regard. Of course, obtaining this information at the time of coconut allergy diagnosis would be subject to recall bias.

Previous studies have examined coconut cross-reactivity to tree nuts (discussed in Polk et al²), buckwheat,³ and lentil⁴ on the basis of experimental evidence of shared epitopes. Varying results have been obtained from large evaluations of cross-sensitization between tree nuts and coconut by skin prick testing (no increased risk¹⁰) and serum specific IgE (association with almond and macadamia sensitization²). In our cohort, cashew allergy was present in 31% of patients, with walnut and hazelnut noted in 9%. Given the skewed population seen at our tertiary referral center, this should not be taken as evidence of a specific association but does support further research examining relevant coconut epitopes. In fact, in our cohort, the incidence of coconut allergy was no higher ($P > .5$) in patients with allergies to tree nut (0.54%) than in those reviewed for any food allergy (0.6%).

TABLE I. Clinical features of coconut anaphylaxis cohort

Patient	Sex	Age at first reaction (y)	Food precipitating first episode of anaphylaxis	Symptoms with first episode of anaphylaxis	Other food anaphylaxis/allergy and atopy	Coconut SPT wheal (mm)
1	F	0.83	Coconut milk*	Angioedema, respiratory involvement, decreased level of consciousness	No other food allergies. Mild eczema.	10
2	F	1	Coconut cream	Coughing, angioedema, erythema	Egg allergy (resolved). Mild eczema (coconut oil used as moisturizer before age 1 y). Aeroallergen sensitized.	8.5
3	F	1	Coconut milk	Urticaria, angioedema, decreased level of consciousness	Egg allergy. Moderate eczema (coconut oil used as moisturizer before age 1 y).	8†
4	F	1.25	Coconut milk	Coughing, hoarse voice, urticaria	Cow's milk anaphylaxis. Mild eczema.	9.5
5	F	1.5	Coconut water‡	Coughing, drooling, urticaria, vomiting	Egg anaphylaxis, peanut and shellfish allergy. Mild eczema. Aeroallergen sensitized.	8.5
6	M	1.5	Baked coconut macaron	Lethargy, angioedema, urticaria	Milk, peanut, banana, sesame allergies. Mild eczema.	7
7	M	2.5	Coconut cream	Lethargy, angioedema, erythema	Egg anaphylaxis, banana anaphylaxis, carrot allergy. Eosinophilic esophagitis. Asthma and allergic rhinitis; aeroallergen sensitized.	7
8	M	3	Coconut water‡	Throat clearing, spitting, coughing, vomiting	Egg anaphylaxis, cow's milk and kiwi fruit allergies. Asthma and allergic rhinitis; aeroallergen sensitized.	8
9	M	12	Coconut-containing bun	Angioedema, lethargy, respiratory distress	Peanut allergy, resolved egg allergy. Severe eczema. Allergic rhinitis; aeroallergen sensitized.	17

F, Female; M, male; SPT, skin prick test.

*See text for further details.

†In addition to skin prick testing, patient 3 was noted to have an elevated total IgE level of 570 kU/L (reference range, <400 kU/L) and elevated specific IgE level of 66 kU/L (<35 kU/L) against a "nut mix" including coconut, peanut, almond, hazelnut, and brazil nut. This patient is tolerant of peanut and almond but was borderline sensitized to hazelnut on skin prick testing (3 mm wheal).

‡Anaphylactic reactions were precipitated by both coconut milk (patients 1, 3, and 4) and coconut water (patients 5 and 8). Coconut water is unprocessed liquid from the inside of young coconuts. As a coconut matures, layers of the cellular content of the coconut water deposit along the walls, forming the flesh. Coconut milk and cream are formed by boiling the flesh with water, filtering out the pulp, and allowing the resultant liquid to settle into layers of higher and lower density.⁶ Therefore, although coconut water and coconut milk differ in protein volume (0.72 g and 2.29 g per 100 g, respectively), they likely contain common proteins. However, the heating required in the preparation of coconut milk and cream may affect the allergenicity of these products.

TABLE II. Comparison of clinical features of coconut anaphylaxis and patients with mild/moderate coconut allergy

Clinical feature	Coconut anaphylaxis (n = 9)	Mild/moderate coconut allergy (n = 26)	Total cohort (n = 35)
Sex: female, n (%)	5 (55)	13 (50)	18 (51)
Age at first reaction (y), mean $\pm$ SD	2.73 $\pm$ 3.35	4.57 $\pm$ 3.73	4.10 $\pm$ 3.72
Coconut SPT wheal at diagnosis (mm), mean $\pm$ SD	9.28 $\pm$ 2.89	5.42 $\pm$ 2.99	6.44 $\pm$ 3.42
Other food allergies (established clinical reaction), n (%)			
Egg	6 (67)	14 (54)	19 (54)
Milk	3 (33)	13 (50)	16 (46)
Wheat	0	3 (12)	3 (9)
Peanut	2 (22)	10 (38)	12 (34)
Cashew	2 (22)	9 (35)	11 (31)
Pistachio	0	6 (23)	6 (17)
Hazelnut	0	3 (12)	3 (9)
Almond	0	2 (8)	2 (6)
Walnut	0	3 (12)	3 (9)
Pecan	0	3 (12)	3 (9)
Macadamia	0	0	0
Sesame	0	4 (15)	4 (11)
Chia seed	0	1 (4)	1 (3)
Fish	0	3 (12)	3 (9)
No other food allergy	1 (11)	0	1 (3)
Other atopy, n (%)			
Asthma	2 (22)	9 (35)	11 (31)
Aeroallergen sensitization	5 (55)	9 (35)	14 (40)
Eczema	7 (78)	19 (73)*	26 (74)

SPT, Skin prick test.

*Two patients were noted to have elevated total IgE levels as part of their eczema workup, of 7970 and 8880 IU/L (reference range, <30 IU/L).

In conclusion, coconut allergy is a rare but real clinical entity, with a spectrum of severity that we have noted to include striking cases of anaphylaxis. Patients with tree nut allergies should be reassured that coconut is a drupe, or stone fruit, not a nut, and that the incidence of true coconut allergy is low in both the general population and those with other food allergies, including to tree nuts. Caution should be taken in the use of coconut-derived skincare products, particularly in children with known atopy. Further studies evaluating culprit epitopes may elucidate potential cross-reactivity between coconut and other allergens.

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