

Anaphylaxis to hidden pea protein: A Canadian pediatric case series

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Clinical Implications

- Pea-derived ingredients in food products may be a relatively underrecognized source of allergy and anaphylaxis. A pediatric case series illustrates a wide range of foods that may contain pea protein.

TO THE EDITOR:

As the health food industry has grown in size and scope, efforts have been made to increase the protein content of foods to appeal to consumers. Plant-based diets are a significant dietary trend and thus a focus for food manufacturers. Peas represent a ready source of additive plant proteins in multiple foods.¹ Although high-protein diets are recommended for certain medical conditions such as diabetes,² and encouraged as an efficient weight loss strategy,³ manufacturers may also target a growing market of individuals consuming, or providing to their children, more plant-based foods. It is important to note that products often make claims of being low in allergenic content.⁴

There are published reports of allergy to a wide variety of legumes: aside from the well-known peanut, these include green peas (*pisum sativum*)⁵ and other peas such as the field pea (*pisum sativum sativum* var. *avense*), also known as the dun pea.⁶ There are 2 main allergens identified in peas: Pis s 1 belongs to the vicilin family, whereas Pis s 2 belongs to the convicilin family. Comprehensive reviews of legume processing and allergenic modification have been published⁷ along reports of coexistent peanut and green pea allergy.⁵

Pea protein isolate is typically created from dun/field peas, and has been identified as a safer alternative to lupine flour, which has been added to the list of allergenic ingredients required to be identified on food labels in the European Union. Originally cultivated for animal food, dun/field pea protein also alleviated consumer concerns over soy protein and its genetic modification.⁶ Pea proteins are not required to be identified as a potential allergen on food labels in the United States or Canada.

A publication from France reported on legume allergy, including small numbers of children who presented with allergic reactions to dun pea, including laryngeal angioedema, urticaria, or asthma exacerbation.⁶ Two children with anaphylaxis to dun pea were reported by the French Allergy Vigilance Network⁶ during the period of 2002 to 2012. There are no corresponding data from North America, and the inclusion of pea protein isolates into many different kinds of foods has continued to increase during recent years.⁴ As such, it may be becoming increasingly important for allergists to recognize pea protein as an allergen deserving of attention.

We report 6 children who presented to a community allergy clinic with allergic reactions to foods that were confirmed to contain pea ingredients (Table 1). With the exception of a pea-based milk substitute, none of these foods was obviously

legume-based; in each case, the pea ingredient would have been added for nutritional benefit. In most cases, the pea ingredient would not have been obvious from the food type: for example, nondairy yogurt, sliced pepperoni, and cookies. In several cases, the reaction was severe and likely to have met criteria for anaphylaxis, according to consensus criteria.⁹

To highlight a representative case, a 10-year old female patient was known to have peanut allergy. She had also experienced clinical allergic reactions to a wide variety of legumes including chickpea, lentils, and green peas, with typical symptoms of periorbital swelling. Legumes were being strictly avoided. Her parent purchased some pepperoni at a specialty deli and prepared a home-made cheese pizza with this pepperoni. Within minutes of ingestion, the patient developed significant facial angioedema, mouth pain, and difficulty swallowing. Parents telephoned the deli and on further inquiry, were told that the pepperoni contained “pea fiber.”

Of the 6 patients, 4 have confirmed peanut allergy with either known clinical reactivity or with strongly reactive skin tests; 2 are able to eat peanuts and tree nuts freely. Several have reacted to other legumes when they were prepared in more obvious ways, such as chickpea, kidney beans, lentils, and green peas. Several had only had mild or nonalarming signs of allergy to legumes before the sentinel event occurred to the pea protein ingredient. For example, patient 1 had previously been noticed to develop mild perioral redness when fed green peas or lentils. At age 32 months, anaphylaxis occurred in the aisle of a grocery store after the patient consumed a sample of nondairy yogurt made with coconut milk and “pea protein” as a listed ingredient. This was the first systemic allergic reaction for this patient, who was subsequently diagnosed with peanut allergy on the basis of very large skin test reaction using threshold values accepted to carry acceptable predictive value.¹⁰

Pea protein isolate may be sold as a powder supplement expressly for health purposes. However, it is food products that include pea protein as a nonobvious ingredient that caused most of the allergic reactions in our case series. Based on the products examined during nearly 5 years of accruing this case series, ingredient labels may state “pea fiber,” “pea hull fiber,” “pea protein hydrolysate,” “hydrolysed pea protein,” or otherwise. Our cases support the observation that high concentrations of pea protein, compared with cooked peas themselves, may increase the chance of systemic reactions from small amounts of food ingested.¹¹ Available products include pea protein concentrates (60%-70% protein), isolates (70%-95% protein), and hydrolysates (90%-95% protein). In comparison, plain cooked yellow peas average 8% protein.¹² Although previous studies suggest that boiling or roasting decreases the IgE-binding capacity for legume allergens,⁷ the products listed above provide much higher amounts of protein than do cooked peas.

On the basis of our observations, we have begun to discuss this issue with patients with clinical histories of other legume allergy. Patients who present with unexplained reactions to deli meats or commercial chicken products are evaluated for the possibility of pea allergy, with other potential culprits such as tree nuts, mustard, or soy. In these cases, we routinely skin test with a fresh or frozen green or yellow pea mash, diluted 1:10 with

TABLE I. Clinical characteristics and confirmatory tests for children presenting with allergic reactions to pea protein ingredients

Patient	Sex	Age at reaction	Food/listed pea ingredient	Reaction reported	PNA	Other food allergies/reactions	Positive skin test results
1	M	2 y 9 mo	Nondairy yogurt/pea protein	Urticaria, periocular swelling, vomiting, altered speech for several hours	Yes	Tree nuts	Green pea baby food 14 mm Pea protein supplement 20 mm
2	F	12 y	Milkshake/pea protein	Tight throat, dizziness, dyspnea	Yes	Tree nuts Chickpea, cooked green peas, golden pea butter	Fresh green pea 18 mm
3	F	3 y 11 mo	Chicken fingers, chicken burgers (same manufacturer)/pea fiber	Itchy tongue, swollen lips, nausea	Yes	Tree nuts	Fresh green pea 20 mm
4	M	14 y	Organic cookie/pea protein	Trouble swallowing	No	Cooked green peas Chickpea, lentils, cooked green peas	Fresh green pea 20 mm
5	F	1 y 5 mo	1. Split pea “milk”/pea protein 2. Nondairy yogurt/pea protein (second reaction)	Facial redness, facial swelling, vomiting	No	Cows milk protein proctocolitis Lentils	Fresh split pea “milk” 15 mm Fresh yellow split pea 20 mm Fresh green pea 12 mm
6	F	10 y	Pepperoni/pea fiber	Facial swelling	Yes	Kidney beans, lentils, chickpea, cooked green peas	Fresh green pea 15 mm

F, Female; M, male; PNA, peanut allergy.

Peanut allergy diagnosed on the basis of a convincing history and positive skin test result (wheal diameter >3 mm *or* >13 mm).⁸

distilled water. The potential for pea sensitization without clinical allergy is considered, and oral challenges offered if needed to distinguish between asymptomatic sensitization and allergy.¹³ We encourage patients and parents to read labels and educate themselves about the variety of foods that may contain pea protein ingredients.

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REFERENCES

1. Relaxnews. “Plant based” will be the hottest food trend of 2018: report. Available from: https://www.huffingtonpost.ca/2017/11/24/plant-based-food_a_23287312/. Accessed December 1, 2018.
2. Zhao WT, Luo Y, Zhang Y, Zhou Y, Zhao TT. High protein diet is of benefit for patients with type 2 diabetes: an updated meta-analysis. *Medicine* 2018;97:e13149.
3. Castro MBT, Cunha DB, Araujo MC, Bezerra IN, Adegbeye ARA, Kac G, et al. High protein diet promotes body weight loss among Brazilian postpartum women. *Matern Child Nutr* 2018:e12746.
4. Agriculture and Agri-Food Canada. Health and Wellness Series - Pea protein isolate in food and beverage products. Available from: <http://www.agr.gc.ca/eng/industry-markets-and-trade/international-agri-food-market-intelligence/pea-protein-isolate-in-food-and-beverage-products>. Accessed December 1, 2018.
5. Wensing M, Knulst AC, Piersma S, O’Kane F, Knol EF, Koppelman SJ. Patients with anaphylaxis to pea can have peanut allergy caused by cross-reactive IgE to vicilin (Ara h 1). *J Allergy Clin Immunol* 2003;111:420-4.
6. Richard C, Jacquenet S, Sergeant P, Moneret-Vautrin DA. Cross-reactivity of a new food ingredient, dun pea, with legumes, and risk of anaphylaxis in legume allergic children. *Eur Ann Allergy Clin Immunol* 2015;47:118-25.
7. Verma AK, Kumar S, Das M, Dwivedi PD. Impact of thermal processing on legume allergens. *Plant Foods Hum Nutr* 2012;67:430-41.
8. Kagan R, Hayami D, Joseph L, St Pierre Y, Clarke AE. The predictive value of a positive prick skin test to peanut in atopic, peanut-naïve children. *Ann Allergy Asthma Immunol* 2003;90:640-5.
9. Sampson HA, Muñoz-Furlong A, Campbell RL, Adkinson NF Jr, Bock SA, Branum A, et al. Second symposium on the definition and management of anaphylaxis: summary report—Second National Institute of Allergy and Infectious Disease/Food Allergy and Anaphylaxis Network symposium. *J Allergy Clin Immunol* 2006;117:391-7.
10. Peters RL, Allen KJ, Dharmage SC, Tang ML, Koplin JJ, Ponsonby AL, et al. Skin prick test responses and allergen-specific IgE levels as predictors of peanut, egg, and sesame allergy in infants. *J Allergy Clin Immunol* 2013;132:874-80.
11. Cabanillas B, Jappe U, Novak N. Allergy to peanut, soybean, and other legumes: recent advances in allergen characterization, stability to processing and IgE cross-reactivity. *Mol Nutr Food Res* 2018;62:1700446.
12. Michigan Medicine - University of Michigan. Pea protein. Available from: <https://www.uofmhealth.org/health-library/hn-10013795>. Accessed December 4, 2018.
13. Sicherer SH. Clinical implications of cross-reactive food allergens. *J Allergy Clin Immunol* 2001;108:881-90.

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