Nonmandatory Labeled Legumes Are an Emergent Safety Concern: An Illustrative Case Report

Vera-Berrios RN[1], Uriarte Vega L[2], Marco-Martín G[1,2], Fernández-Rivas M[1,2,3]

[1]*Allergy Research Group, Hospital Clínico San Carlos, IdISSC, Madrid, Spain*

[2]*Allergy Department, Hospital Clínico San Carlos, Madrid, Spain*

[3]*Facultad de Medicina, Universidad Complutense, Madrid, Spain*

J Investig Allergol Clin Immunol 2025; Vol. 35(1)
doi: 10.18176/jiaci.1020

Key words: Legume allergy. Pea allergy. Hidden allergens. Anaphylaxis.

Palabras clave: Alergia a legumbres. Alergia a guisante. Alérgenos ocultos. Anafilaxia.

Legumes, such as soy, peas, and lentils, are rich in protein, fiber, and other essential nutrients. The use of legume proteins in the food industry has increased exponentially owing to their excellent nutritional value and their potential as a sustainable protein substitute for animal-based protein sources. As a result, legume proteins are being incorporated into various food products and becoming widespread, especially in recent years, with changes in dietary habits towards plant-based protein sources [1-3].

The only legumes included in the European labeling directive are peanut, soy, and lupin (https://eur-lex.europa.eu/eli/reg/2011/1169/2018-01-01). Furthermore, given that nonmandatory labeled legumes such as lentils, chickpeas, and peas are increasingly present in a variety of foods, we must remember that they can cause allergic reactions and even anaphylaxis in allergic patients, either through primary sensitization or cross-reactivity [2-8].

We present the case of a 36-year-old woman with a history of legume allergy since childhood. She also had a history of rhinoconjunctivitis and mild asthma due to pollen allergy. At 1 year of age, she experienced a reaction to lentils and chickpeas, presenting with pruritic exanthema and facial angioedema. Four years later, she experienced another episode of urticaria and facial edema after ingestion of pea. At the age of 24, she had 3 separate episodes of rhinoconjunctivitis, urticaria, and dyspnea after skin contact with lentils at the school canteen where she then worked. At the time of the patient's first visit to our department in 2008, she avoided chickpeas, lentils, and peas while tolerating white and green beans and eating peanuts occasionally. However, since the first allergy work-up in our clinic, she stopped eating all legumes. The patient gave her written consent for publication of her medical data.

Despite a correct avoidance diet, she has had 19 episodes of anaphylaxis in 16 years, 12 of them associated with cofactors such as alcohol or exercise. Using the Food Allergy Severity Score [9] to grade the severity of these reactions, almost all were potentially life-threatening, with 16 reactions involving the airways and/or larynx (grade 4), 2 involving the cardiovascular system (grade 5), and only 1 milder reaction (grade 3) with skin and gastrointestinal symptoms. These episodes occurred after the consumption of a variety of previously processed or ready-to-eat foods, such as fast-food burgers, pizza, various types of bread, cereal bars, surimi sticks, and ketchup (Supplementary Table 1).

We performed skin prick tests (SPTs) (ALK, Madrid, Spain), prick-prick tests, and serum IgE determinations (sIgE) to whole extracts and individual allergens (ImmunoCap, ISAC, Thermo Fisher Scientific/Phadia) for inhalants, legumes, cereals, nuts, and seeds.

The patient was sensitized to grass, olive, and cypress pollen. Tryptase values were within the normal range, and sensitization to cereals, nuts, and seeds was ruled out. She presented positive SPT and/or sIgE results for pea, lentil, chickpea, peanut, soy, white and green beans, and lupin. The molecular diagnosis showed positive results to Ara h 1 (7S globulin), nGly m 5 (β-conglycinin), and profilins. Negative results were obtained for ω-5 gliadin, nonspecific lipid transfer proteins, PR-10 proteins, α-gal, and the remaining storage proteins included in the microarray (Table). One significant limitation is the absence of allergen components of legumes other than peanut and soy in the ISAC microarray.

After an exhaustive analysis of all the ingredients of the available eliciting foods, we were only able to identify the offending allergen in 12 out of 19 reactions (63%) (Supplementary Table 1). We found that different legume proteins were present, namely, broad-bean flour, soy protein, lupin, and pea protein, with pea protein listed in some of the foods as vegetable protein or pea fiber (Supplementary Table 1).

The prevalence of legume allergy varies across countries, and it has not been clearly established, especially that of nonmandatory labeled legumes such as lentils, peas, chickpeas, and beans [3]. Sensitization and allergy to legumes tend to be more frequent in regions where they are commonly consumed, such as the European countries of the Mediterranean basin and Asian countries [2,3,5,6-8]. In Spain, for instance, allergy to lentils, chickpeas, and peas is not uncommon, especially in children [3,6,8].

The increasing use by the food industry of flours and protein isolates from nonmandatory labeled legumes such as lentils, chickpeas, beans, and, particularly, peas may generate an important safety concern for patients who are allergic to them [3,5,7,8,10].

Although peas are less commonly involved in allergic reactions than other legumes, such as peanuts and soy, it should

Table. Accidental Legume Reactions and Allergy Work-up.

Legumes	Allergy work-up						
	SPT, mm		sIgE, kU_A/L		Culprit allergen	Severity (oFASS-5)[a]	Reactions, No.
	2008	2024	2008	2024			
Pea	14	6	59.3	7.75	x	Grade 4	3
Lentil	20	10	55.1	8.04			
Chickpea	13	7	54.6	7.18			
Peanut	3	0	13.6	2.06			
Soybean	5	0	3.81	0.62	x	Grade 4	4
Grass pea[b]	ND	ND	58.9	ND			
Lupin	ND	ND	14.7	1.82	x	Grade 4	2
Bean	0	0	5.99	1.24	x	Grade 4	1
Broad bean	ND	6.5	ND	ND	x	Grade 4	2
Not identified					x	Grade 5	7

	sIgE - ISU-E	
Food allergen component	2008	2024
rAra h 1[c]	1.4	1
nGly m 5[c]	0.9	3.4
nsLTPs[c]	<0.3	<0.3
PR-10s[c]	<0.3	<0.3
Profilins[c]	2.2-9.4	17-38
Other storage proteins[c]	<0.3	<0.3

	2008	2024
Total IgE, kU/L	716	299
Baseline tryptase, µg/L	2.2	4.51

Abbreviations: oFASS, Ordinal Food Allergy Severity Score (oral cavity); ND, not done; nsLTP, nonspecific lipid transfer protein; sIgE, serum IgE determination; SPT, skin prick test.
[a]Most severe reaction to each legume.
[b]*Lathyrus sativus*.
[c]ISAC® platform

be noted that they are currently found in a wide variety of foods and at high concentrations as pea protein concentrates, isolates, and hydrolysates, thus potentially increasing the likelihood of experiencing a systemic reaction, even with small amounts of food ingested [1,3,5,8,10]. The reactions experienced by the patient in the present case involved very different types of food, from ketchup containing lupin to surimi sticks made from pea protein. Notably, nearly half of the reactions involved bread or dough-based or dough-derived products, highlighting the ubiquitous presence of pea and other legume proteins in a wide range of foods, particularly bread-based ones. It is also noteworthy that in 4 of the anaphylactic reactions, the patient had eaten beef burgers and, in another reaction, sausages. It is well known that vegetable protein, from both soy and pea, is often added to these meat preparations. In conclusion, we should be aware that a surge in sensitization and anaphylaxis to pea and, to a lesser extent, other nonmandatory labeled legumes, is likely to occur.

Therefore, vigilance in identifying and managing hidden pea and legume allergens is crucial for both health care professionals and patients. Hence, the mandatory labeling of peas along with appropriate labeling standards that disclose all ingredients should be urgently addressed. In the meantime, allergic patients should be aware of current labeling limitations and be advised not to consume foods that list pea protein hydrolysate, hydrolyzed pea protein, pea fiber, pea hull fiber [10], unidentified flours, or plant or vegetable proteins [5,7].

Continued research and collaboration between food scientists, allergists, and regulatory agencies are essential if we are to advance the use of legume proteins in the food industry while addressing allergenic concerns and ensuring consumer safety.

Funding

This work was supported by Instituto de Salud Carlos III (ISCIII), cofunded by Fondo Europeo de Desarrollo regional (FEDER) for the Thematic Research Network ARADyAL (RD16/0006/0009) and project PI19/01095.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Previous Presentation

Study data were presented in part as oral case reports at the 2018 "Sesiones Interhospitalarias de la Sociedad de Madrid-Castilla La Mancha de Alergología e Inmunología Clínica" and the 2019 European Anaphylaxis Registry (NORA) meeting.

ORCID

Rosialzira Natasha Vera-Berrios https://orcid.org/0000-0002-8623-6326
Guadalupe Marco-Martín https://orcid.org/0000-0003-1754-3274
Montserrat Fernández-Rivas https://orcid.org/0000-0003-1748-2328

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Manuscript received March 15, 2024; accepted for publication May 24, 2024.

Montserrat Fernández-Rivas
Allergy Department, Hospital Clínico San Carlos
c/ Prof. Martin Lagos s/n
28040 Madrid, Spain
E-mail: mariamontserrat.fernandez@salud.madrid.org