Allergy to White Kidney Beans With Cross-reactivity to Red Kidney Beans: Report of 2 Cases in Children

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Legumes are dicotyledonous plants belonging to the Fabales order. These include white and red kidney beans (*Phaseolus vulgaris*), which are members of the Fabaceae family. Legumes are a rich source of proteins, fiber, and minerals and are consumed worldwide, although they have also been reported to be potential triggers of IgE-mediated reactions [1], and while clinical manifestations of legume allergy vary from local symptoms to systemic reactions, the latter are rarely reported [2]. Rouge et al [3] and Zacharisen and Kurup [4] reported 2 cases of anaphylaxis to kidney beans. In Spain, allergy to legumes is the fifth most common cause of food allergy in children, and beans are the third most consumed species of legumes after chickpeas and lentils. Clinical allergy to several legumes is very common, especially in children, owing to their high degree of cross-reactivity [5,6]. Ibañez et al [7] showed white kidney beans to be well tolerated by children allergic to other legumes, although the exact reason has not yet been elucidated. Only a few cases of kidney bean allergy have been reported, and the information available concerning the specific allergens involved and their molecular characteristics is scarce.

We present 2 clinical cases of children with IgE-mediated allergy to kidney beans and tolerance to other legumes.

The first patient was a 5-year-old boy with a past medical history of spontaneously outgrown egg allergy and atopic dermatitis who developed pruritic erythematous wheals on the neck, nape, and face immediately after eating cooked white kidney beans, which were previously tolerated. Symptoms resolved with antihistamines. He subsequently tolerated lentils, chickpeas, green beans, and peas. Skin prick tests (SPTs) were negative with commercial legume extracts (LETI Pharma). Prick-by-prick tests with cooked legumes yielded wheals of 9 mm for white kidney beans and 8 mm for red kidney beans. SPTs to other legumes were negative. Total IgE was 2360 IU/mL. Specific IgE (sIgE) was 0.92 kU/L for white kidney beans, 0.25 kU/L for pea, 0.46 kU/L for chickpea, 0.64 kU/L for lentil, 0.62 kU/L for soy, and 0.29 kU/L for peanut.

The second patient was an 8-year-old boy with a past medical history of spastic bronchitis after respiratory infections who presented generalized erythematous wheals and abdominal discomfort after eating white kidney beans and facial angioedema after eating red kidney beans. Both reactions were treated successfully with corticosteroids and antihistamines. He subsequently tolerated lentils, chickpeas, peas, green beans, and soy. Previous tolerance to both beans was reported. SPTs with commercial legume extracts (LETI Pharma) yielded wheals of 3 mm for beans, 4 mm for lentils, and negative results for the remainder. Prick-by-prick testing with cooked vegetables yielded wheals of 13 mm for white kidney beans, 9 mm for peas, 5 mm for chickpeas, 10 mm for red kidney beans, and 7 mm for lentils. Total IgE was 219 IU/mL. sIgE was 10.7 kU/L for white kidney beans, 4.02 kU/L for green beans, 2.59 kU/L for pea, 1.58 kU/L for chickpea, 2.26 kU/L for lentils, 3.38 kU/L for soy, and 4.83 kU/L for peanut.

In both these cases, sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) immunoblotting was performed to study the molecular mass of proteins from various legumes (white and red kidney beans, pea, lentils, green beans, peanut, and soy). We found that molecular mass ranged from 18 to 68 kDa. Western blot was performed with legume extracts against the patient's serum. In both cases, we detected bands of approximately 48-50 kDa in the extracts of white and red kidney beans and a band of approximately 28-31 kDa in the extracts of white, red, and green bean and

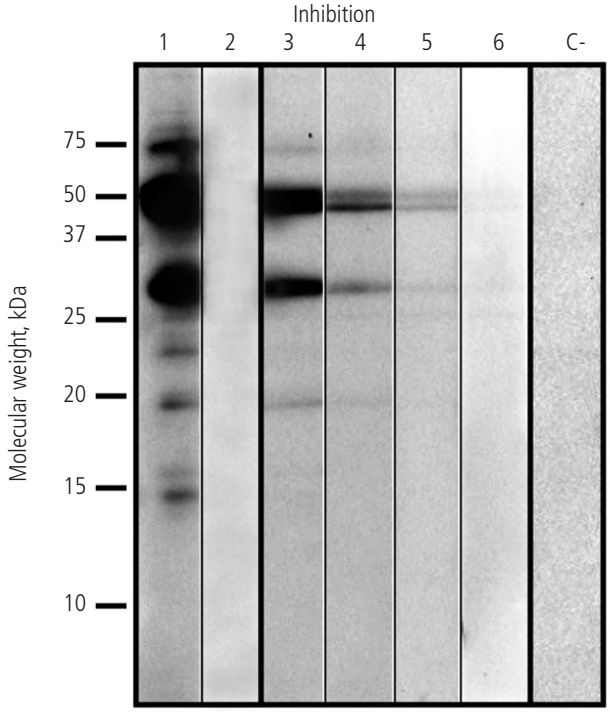

Figure. Western blot inhibition of red bean vs white bean. Lane 1, red bean not inhibited; lane 2, red bean inhibited with 2.90 mg/mL of red bean (homologous); lane 3, red bean inhibited with 0.045 mg/mL of white bean; lane 4, red bean inhibited with 0.18 mg/mL of white bean; lane 5, red bean inhibited with 0.725 mg/mL of white bean; lane 6, red bean inhibited with 2.9 mg/mL of white bean; C-, negative control (white bean with serum from a nonatopic patient).

soy. These bands were not recognized in the other legume extracts (Supplementary figures A and B). In the second case, Western blot inhibition was carried out with red and white kidney beans; all the proteins in the red kidney beans were inhibited by the white kidney beans as concentrations were increased (Figure).

Allergy to kidney beans with tolerance to other legumes is rare. Some allergens have been purified and characterized from these legumes. Kasperick and Ownby [8] suggested that the major allergens of dry beans were in the albumin fraction, and Rouge et al [3] reported that phaseolin and phytohemagglutinin could be the proteins responsible for the allergic reactions. A 31-kDa protein and a 47.5-kDa protein are considered major allergens of kidney beans and have been identified as phytohemagglutinin and phaseolin, respectively [9,10].

In our study, immunoblotting of white and red kidney beans showed chemiluminescence in bands of approximately 47-50 kDa and 28-31-kDa. The first protein could correspond to a phaseolin in white kidney beans, as previously described by Kumar et al [10] in red kidney beans. Both proteins show homology in Western blot inhibition. These results are expected, as there is no fundamental difference in the protein content between dried kidney beans (white, 22.9 g per 100 g; and red, 24 g per 100 g). The second protein could correspond to a phytohemagglutinin, as described by Kasera et al [9].

We think that the culprit proteins in both cases could be the 47- to 50-kDa band. These were only detected in white kidney beans with cross-reactivity to red kidney beans.

As reported in previous publications, we highlight that diagnosis of legume allergy should not be based exclusively on specific IgE in order to avoid unnecessary dietary restrictions. Although serological cross-reactivity between legumes is very common, its clinical relevance remains controversial [7], as evidenced by the second patient, whose tests indicate high IgE levels for more legumes even though he tolerated them. In contrast, in the first patient, although no reaction was reported with red kidney bean, oral challenge was not carried out owing to the high positivity of the SPT result and the demonstrated cross-reactivity between white and red kidney bean. The patient was subsequently recommended to avoid the food.

In conclusion, we report 2 cases of selective allergy to white and red kidney beans in children, demonstrating IgE-mediated sensitivity and detection of proteins at 47-50 kDa and 28-31 kDa. These could correspond, respectively, to phaseolin and phytohemagglutinin. Further studies are needed to isolate and characterize major allergens of kidney beans, establish their allergenicity, and assess possible cross-reactivity with other legumes and between different bean species.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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