

Potato Allergy. Changes Induced by Heat

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Abstract

The introduction of new foods in the children's food pyramid has caused the emergence of new allergies, many of them still without identifying the responsible protein, so the spectrum of food allergies is growing exponentially.

Potato, a basic food tuber in the children's diet, and used as a basis for the preparation of multiple recipes worldwide, is tolerated by the majority of children and adults although sometimes there are cases of allergic reactions in which the indication Initial by doctors is to remove this food from the diet, sometimes causing alterations in the basic principles that a child should receive.

We investigated the case of a patient who, by chance, tolerated potatoes although he was previously diagnosed as allergic to this food. However, what is really interesting is that it has been found that the application of heat can vary the structure of an allergenic protein such as Sol t1.

We conclude that it is necessary to identify in most foods, the possibility of tolerance if we apply heat in different ways.

Keywords: *Potato Allergy; Heat; Patatin; Immunoblotting*

Introduction

The potato (*Solanum tuberosum*) is an herbaceous plant belonging to the *Solanum* genus of the Solanaceae family, native to the region between the southern highlands of Peru and north western Bolivia. In the sixteenth century it began to be transferred to Europe by the Spanish conquerors who considered it a botanical curiosity and not a food plant. Its consumption was growing, although at the beginning as a forage and garden plant for its flowers, and its gastronomic use expanded to the whole world from the 18th century until today becoming one of the main foods of the human being.

The feeding of children from 6 months of age is based mainly on the introduction of vegetables and especially potatoes, this being the basis of the contribution of carbohydrates in the first months of both somatic and intellectual development. It is this frequency in the use of the potato, which allows few allergic reactions since tolerance usually begins in early stages of life and even the potato is used as the basis for the preparation of other foods such as sweets, pastry, etc.

A case of a known and previously diagnosed patient of potato allergy is presented, with episodes of anaphylaxis; food allergy that was modified based on heat contributed to the food which allowed to vary the structure of the protein and be tolerated by said patient.

The study of this patient was carried out with the objective of knowing how in some situations the patient developed anaphylaxis and in a special situation he tolerated the food.

Finally, the different ways of applying heat that is used when cooking this food in particular, can modify the exposure to certain allergenic proteins that are modified in its conformational structure, so it would be advisable when a food allergy appears to assess whether the structure of The allergenic protein can be altered by the application of heat, thus allowing to open more possibilities of food consumption in allergic patients.

Case Report

5-year-old male patient, previously diagnosed with food polyallergy with potato sensitization, lentils, chickpeas, white beans, hake and different types of fish, presenting in most cases the presence of oral pruritus on contact with these foods and generalized urticarial with everyone.

In the case of the food studied, the potato, the first allergic reaction with 7 months of life is found, debuting with a picture of anaphylaxis with hives, cough, abdominal pain that ends in diarrhoea, about 20 minutes after ingesting a puree containing the following cooked foods: potato, carrot, squash, celery, leek and olive oil.

After remitting anaphylaxis and being discharged from the hospital, specific IgE determinations were made to these foods with the results of:

- Potato: 34.5 IU/ml
- Carrot, squash, celery, leek, olive: < 0.35 IU/ml.

Despite these results, the patient was cited for several tests of oral exposure to foods with specific negative IgE, resulting in tolerance to them. Finally, in the oral potato exposure test, when exposing raw and cooked potato to the oral mucosa, he began with crying, irritability, developing in the following minutes a hyperaemia picture of the inner mucosa of the lower lip and oedema that remitted spontaneously after about 10 minutes, so the continuation of the oral provocation test was suspended.

During the following years, the potato, as well as all commercial preparations that could include such food, were removed from the patient's diet.

At the age of 2 years the analyses performed were repeated. In the first place, Prick by Prick studies with raw and cooked potatoes were obtained, obtaining 5 x 4 mm and 4 x 4 mm beans respectively. Next, a specific IgE study was requested again, giving a result of 29 IU/ml. The parents in this case rejected the possibility of performing oral provocation tests with both foods, so they remained diagnosed with potato allergy and avoidance of food in their usual diet.

At the age of 5, the patient goes to a family event and accidentally ingests a mixture of different foods, including commercial fries. When the parents warn, they go to a hospital where they remain under clinical observation for 12 hours without observing the presence of allergic reactions, being referred to pediatric allergy consultations to assess the possibility that potato-specific IgE has disappeared.

Materials and Methods

Upon reassessment in our pediatric allergy consultations, the allergic serological tests are repeated and a potato result of 31 IU/ml and Sol t1 of 25 IU/ml is obtained. Given this, parents sign authorization to perform 4 tests of oral provocations in the following order:

1. Fried potato in olive oil of a commercial brand similar to that ingested with the family,
2. Fried potato in olive oil at home at 140°C for 10 minutes,

3. Cooked potato without skin in water at home at 90°C for 20 minutes,
4. Raw potato without skin.

Frying and cooking temperatures were measured with an infrared thermometer.

The results in the provocation tests, carried out on different days every 24 hours to avoid the bias of food absorption during digestion, reflect the following data:

- With the commercial fried potato did not present allergic reaction being considered negative test,
- With the fried potato at home he did not present an allergic reaction being considered a negative test,
- With the cooked potato at home initially presented oral pruritus and after 15 minutes of ingesting facial rash and abdominal pain being considered positive test,
- With raw potato developed pruritus and edema of the inner mucosa of the lower lip when coming into contact with it without eating it, being considered positive test.

Given these data, it remained to be determined whether the cause of the tolerance was the difference in temperature at which the food was exposed, which would modify the structure of the protein or that when using olive oil an oily layer formed to cover the food by changing its Absorption capacity.

Therefore, serum samples were obtained from the patient to carry out an immunoblotting study and compare the presence of potato proteins, both skin and pulp, and compare them with the results of the fried potato and cooked potato.

In immunodetection performed with potato skin, a recognition of high molecular weight allergens 45 kDa and 17 kDa of low molecular weight is observed (lane 1).

Subsequently with potato pulp these are restricted to two clearly delimited bands at 20.1 and 25 kDa (lane 2).

When processing with heat at 90°C for 20 minutes, the allergens are denatured and only recognition bands are observed at 30 and 21 kDa (lane 3), but if the heat increases to 140°C and within 10 minutes the total elimination of allergens from the potato (street 4).

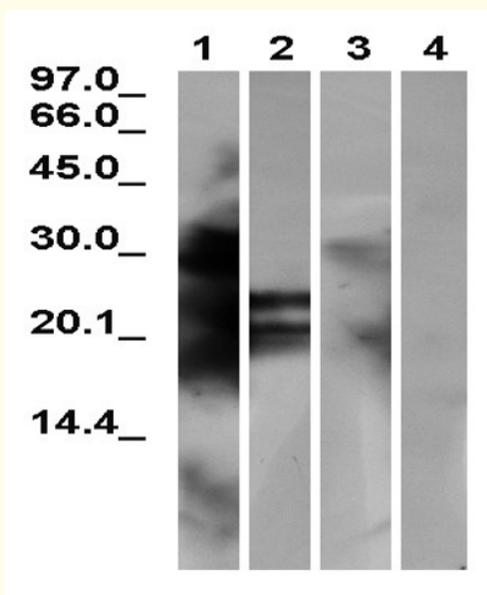


Figure 1

Discussion

The major potato protein, known as Patatín or Sol t1, is a lipoprotein from the group of storage protein honeycombs, although it is also recognized as a lipase activity and can act by separating fatty acids from lipids from membranes.

It is not the only protein present in the potato, since we can specify that up to 4 subclasses of Sol t have been able to be identified based on their molecular weight: Sol t1 (43 kDa), Sol t2 (35 kDa), Sol t3 (21 kDa) and Sun t4 (16 kDa) [1].

However, it has been possible to define papatin as the major protein with more representation in the pulp of the potato, of those hitherto known as demonstrated in the comparisons of the different authors studied [2].

Its three-dimensional structure is known and is represented in the following figure 2[3].



Figure 2

Allergic reactions to food can vary in its presentation from mild as rash, passing through episodes of oral allergy syndromes or even triggering anaphylaxis reactions that require the use of adrenaline IM. In our case, the most frequent reactions were dermal involvement, varying between rashes to facial urticaria and even associating digestive symptoms at some point, which would be considered anaphylaxis. This does not differ from that found by most authors in which dermatological reactions are the most abundant [4,5] although many cases of anaphylaxis are also described [6].

In addition, the fact that Sun t1 belongs to the family of storage proteins increases the chances of suffering or suffering from anaphylactic reactions by behaving as cross-reaction proteins with others present in different foods.

Legumes, nuts, and seeds are important triggers of food allergy, frequently causing severe symptoms and even life-threatening anaphylactic reactions. The major allergens responsible are storage proteins from three families: 2S albumins, 7S globulins, and 11S globulins. These allergens are characterized by high stability to heat and gastrointestinal enzymes. Sensitivity to storage proteins often leads to serological cross-reactivity between legumes, nuts, and seeds, although this is frequently without clinical relevance. One

benefit of molecular diagnostics with storage proteins is the possibility of distinguishing primary, potentially dangerous allergies from pollen-associated, Bet v 1, or profilin-associated allergies, most of which lead only to mild symptoms [7,8].

The diagnosis of these allergies is sometimes difficult since although we have molecular diagnostic methods that identify the specific protein, however we must not forget that there are other techniques such as immunoblotting, which is to submit a serum sample that we want to study comparing it with the extract of the food or products that serve as reference, to an electric current that would cause the displacement of the proteins based on their molecular weight, which allows to identify those proteins with greater risk of allergenicity [9].

That is why the clinical case presented is important because it has been possible to demonstrate how it is possible to tolerate the same food by being subjected to different temperature stages which can open a door of hope for thousands of food allergic patients, and especially in polyallergics that have reduced their ability to access food, and even avoid situations of social rejection of these patients or involvement in the psychological plane.

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Conclusion

In this case, it is verified how the application of high heat in a shorter period of time modifies the structure of the proteins in comparison to the heat of less intensity even if it is for a longer period of time allowing a better tolerance of the food in question.

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