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A case of rice allergy in a patient with baker's asthma

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Key words

Rice allergy, baker's asthma, Lipid transfer protein (LTP), α-amylase/trypsin inhibitor, component resolved diagnosis (CRD)

Summary

A case of rice allergy in a patient with baker's asthma is described. On ISAC 112 IgE reactivity to wheat α-amylase/trypsin inhibitor (nTri a aA_TI) and Lipid Tranfer Protein (rTri a 14) was found. We hypothesize that the reaction by oral ingestion was elicited by homologous molecules in rice seeds.

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Introduction

Rice (Oryza sativa) is a cereal produced and consumed in large quantities around the world, especially in Asian countries, but hypersensitivity reactions are rare. Allergic reactions to rice were first reported in patients experiencing asthma following rice flour exposure and eczema exacerbated by rice ingestion (1,2). More recently some cases of anaphylaxis triggered by ingestion of cooked rice or inhalation of rice dust or vapor from boiling rice have been reported (3-5). Several potential allergenic components of rice seed have been described so far, including Ory s aA-TI, a 14-16 kDa member of the α-amylase/trypsin inhibitor family, Ory s 19 kDa, a member of 2S albumin family, a 33 kDa allergen with glyoxalase I activity (Ory s Glyoxalase I), two proteins of 52 (Ory s GLP52) and 63 (Ory s GLP63) kDa respectively, both members of the cupin superfamily, and Ory s 14, a lipid transfer protein (LTP), member of prolamin superfamily (6).
We describe the case of a patient with a history of baker's asthma, who showed several anaphylaxis events after the ingestion of rice.

Case report

A 65-year-old man with a history of baker's asthma for 10 years presented at allergy unit after experiencing at least four episodes of generalized urticaria, rhinitis with sneezing, and dyspnea, all within 30 min after eating a 'risotto' dish or other foods containing cooked rice flour. The patient did not report any adverse reaction following the in-

gestion of other cereals or beer, but on one occasion when he suffered from breathlessness while draining pasta. Skin prick tests (SPTs) with a battery of common commercial inhalant (Lofarma, Milan, Italy) and food allergen extracts (cow's milk, egg white, shrimp, codfish, peanut, soybean, walnut, hazelnut, tomato, peach, celery, sesame seed, kiwi, banana, almond,) (Stallergènes, Antony Cedex, France) scored all negative. SPTs with commercial wheat and oats extract (Lofarma) as well as a prick-prick with wheat and raw rice were clearly positive (wheal: > 4 mm of diameter). A prick-prick with boiled rice scored weakly positive (wheal: 2 mm of diameter). Total IgE concentration was 135 kU/l, and specific IgE (ImmunoCAP, Phadia, Uppsala, Sweden) to rice, barley, wheat, and maize were 6.86 kU/l, 23.4 kU/l, 1.14 kU/l, and 1.1 kU/l, respectively. A component resolved diagnosis (CRD), using the last version (October 2011) of immunoCAP ISAC (ImmunoCAP, Phadia, Uppsala, Sweden), able to identify simultaneously IgE to 112 different allergen molecules, was performed. Patient's serum reacted to wheat allergens nTri a aA_TI (α-amylase/trypsin inhibitor) (0.4 ISU) and rTri a 14 (LTP) (0.5 ISU). All the remaining 110 allergen molecules scored negative (however, notably, the panel does not include any rice allergen). An immunoblot with both raw and cooked rice, performed as previously described (5), scored negative. Due to the severity of the reported allergic reaction the patient was not submitted to an open or double-blind placebo-controlled challenge tests with rice.

Discussion

In this study we reported one case of rice-induced anaphylaxis that occurred in a patient known to have baker's asthma. The CRD showed positivity to α-amylase/trypsin inhibitor (nTri a aA_TI) and to wheat LTP (rTri a 14), two major allergens that have been associated with baker's asthma (7,8,9), but also with food allergy to wheat. Notably, the α-amylase inhibitor family (10) and the LTP (5) represent two rice allergens. In this clinical case we can hypothesize that Tri a aT_TI and Tri a 14 were the primary sensitizers and the causative allergens of baker's asthma. Since proteins homologous of these wheat allergens are present in rice seed the reported allergic reactions to rice are most probably the result of a cross-reactivity with wheat allergens. We were not able to confirm our hypothesis by immunoblot inhibition , because the immunoblot with both raw and cooked rice was negative most probably due to the low levels specific of specific IgE (or of allergen) that were below the detection limit of this technique. If wheat was the primary sensitizer, it remains unclear why wheat was tolerated as a food while rice was not. Previous studies may partly explain this apparent contradiction. It has been shown that LTPs from the Triticaceae (wheat, barley, and rye) are structurally distinct from those in maize, rice and fruits (11) and possess an aspartate residue at position 7 which can be modified by the addition of a lipid-like adduct (12). This occupies the lipid-binding tunnel and increases protein dynamic (9), which might also reduce the proteins' stability upon processing. Such observation may explain why individuals with baker's asthma who are sensitized to wheat LTP by inhalation, can generally ingest baked wheat without any consequence. Furthermore, Pastorello and co-workers demonstrated that wheat LTP is less resistant to cooking than maize LTP, a fact that has been ascribed to the unfolding of wheat LTP. There is scant literature about the effects of processing on rice allergens. Asero and coworkers (5) showed an in vitro loss of IgE reactivity to whole cooked rice, similarly to that we observed on SPT with boiled rice in our patient. The incorporation of LTP into the macromolecular matrix (e.g. starch) during cooking procedures leading to a reduced interaction between the allergen and specific IgE might be an explanation of this fact. However, in vivo such matrix should be digested in gastrointestinal tract, making LTP recognizable again by specific antibodies. Alternatively, the reduced reactivity to cooked rice might be due to the partial loss of the allergen into the cooking water. The presence of allergen(s) into cooking water leading to their inhalation in an aerosolized form may explain the asthma attacks that occurred in our patient while draining pasta.

In conclusion, we hypothesize that in this patient one or both rice allergens, homologous to those triggering backer's asthma by inhalation, have caused anaphylaxis by ingestion although we cannot exclude a genuine sensitization to other specific rice allergens that are not yet available for in-vitro CRD.

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