

Case Report

Food-dependent exercise-induced anaphylaxis to flaxseed

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ABSTRACT

The present paper reports on a 26-year-old atopic patient suffering from seasonal rhinoconjunctivitis and flexural eczemas. On two occasions, he experienced nausea, generalized urticaria and dyspnea within 2 h after consumption of a wholemeal roll and subsequent exercise (football training or walking). In each case, the episode necessitated intravenous emergency therapy with an antihistamine and a corticosteroid. In order to elucidate the two exercise-induced anaphylactic events we performed prick tests and the radioallergosorbent test (RAST) with the ingredients of the wholemeal roll. Only flaxseed gave positive results. In addition, we performed an exercise test on a bicycle ergometer (15 min at 150 W) and an oral challenge test with foods, using a double-blind and placebo-controlled study. Only oral challenge with a teaspoon of flaxseed with additional exercise on the bicycle ergometer elicited itching, urticaria, nausea, coughing and dyspnea. The oral challenge with flaxseed followed by exercise induced immediate-type reactions and, thus, led to the diagnosis of food-dependent exercise-induced anaphylaxis to flaxseed.

Key words: atopy, double-blind placebo-controlled food challenge, exercise-induced anaphylaxis, flaxseed, wholemeal roll.

INTRODUCTION

Food-dependent exercise-induced anaphylaxis is a severe form of allergy in which ingestion of a specific food

before physical exercise induces symptoms of anaphylaxis. Patients typically have IgE antibodies to the food that triggers the reactions; however, ingestion of the food causes no symptoms if not followed by exercise.¹

In a large series comprising 102 patients with idiopathic anaphylaxis Stricker *et al.*² performed prick tests using a panel of 79 foodstuffs. Ten different foodstuffs were identified as causative agents of anaphylaxis, including flaxseed in one case. We report on a 26-year-old patient who suffers from exercise-induced food allergy to flaxseed.

CLINICAL SUMMARY

Within 2 h after consumption of a wholemeal roll and subsequent football training, the patient suffered from nausea, generalized urticaria and dyspnea. In the second event, ingestion of a wholemeal roll followed by walking again caused urticaria, angioedema and dyspnea within 2 h. In each case, the episode necessitated intravenous emergency therapy with an antihistamine and a corticosteroid.

In addition, the patient complained of rhinoconjunctivitis, which occurred between April and August. Itching in the oral cavity occurred after consumption of hazelnuts and walnuts and the patient has had recurrent flexural eczemas ever since childhood.

In order to elucidate the two exercise-induced anaphylactic events and the other symptoms, we performed prick tests with pollen (commercially available test solutions) and native material of nuts and the ingredients of the wholemeal roll supplied by the baker. Performance and assessment of the prick tests followed the recommendations of the European Academy of Allergy and Clinical Immunology.³ For detection of specific IgE antibodies in the serum we performed a radioallergosorbent test (RAST; CAP-RAST FEIA, Pharmacia, Freiburg, Germany) for pollen, nuts and the ingredients of the

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wholemeal roll. The test results are summarized in Table 1. Positive reactions were obtained in the case of pollen to trees, rye and grasses; in the case of nuts, positive reactions were obtained to hazelnuts, walnuts and almonds. In the case of the wholemeal roll, a positive reaction was obtained only to flaxseed. Control tests with flaxseed in 10 volunteers produced negative results. In addition, we performed an exercise test on a bicycle ergometer (15 min at 150 W) and an oral challenge test with foods, using a double-blind and placebo-controlled food challenge (DBPCFC) study (neither the patient nor the physician knew of the contents of the challenge; sesame was used as the placebo). The fasting exercise test on the bicycle ergometer produced no reactions. Oral challenge with a teaspoon of sesame or flaxseed alone did not elicit any reaction. The next day, the oral challenge was repeated with one teaspoon of flaxseed. This was followed with additional exercise on the bicycle ergometer. Itching, urticaria, nausea, coughing and dyspnea occurred within 2 h. The patient received intravenous injections of 4 mg dimetindene maleate and 250 mg methylprednisolone, as well as 30 drops metoclopramide and three puffs of Fenoterol HBr (Boehringer Ingelheim,

Germany) controlled-dosage inhaler. This improved the symptoms within minutes.

DISCUSSION

Food-dependent exercise-induced anaphylaxis is regarded as a subset of classic exercise-induced anaphylaxis, a distinct form of physical allergy for which the reaction is precipitated by exercise only.⁴ Although various foods (including celery,¹ shellfish,⁵ hazelnuts and peanuts⁶) have been associated with food-dependent exercise-induced anaphylaxis, the most frequently reported cause of these reactions seems to be wheat.^{6–8} The type of activities required to precipitate symptoms include running, soccer, basketball and walking.⁹ The diagnostic work-up for food-dependent exercise-induced anaphylaxis includes prick tests and RAST with a wide panel of food allergens.¹⁰ On the basis of these findings, oral food challenges with the suspected food followed by exercise (e.g. bicycle ergometer) is recommended.

Our patient was atopic and suffered from flexural eczema, allergic seasonal rhinoconjunctivitis in conjunction with allergy to pollen of trees, rye and grasses, as well as an oral allergy syndrome to nuts. The positive skin test and the detection of specific IgE antibodies made it possible to demonstrate an immediate-type allergy to flaxseed. Identification of exercise-induced anaphylaxis is best accomplished by oral challenge using a DBPCFC.¹¹ Oral challenge with flaxseed followed by exercise induced immediate-type reactions, such as urticaria, nausea, coughing and dyspnea, and, thus, led to the diagnosis of food-dependent exercise-induced anaphylaxis to flaxseed. Because of its high content of polyunsaturated fats, flaxseed is increasingly being used as a foodstuff supplement in baked goods. Therefore, further anaphylactic reactions to flaxseed must be expected.¹²

Flax is a plant that belongs to the Linaceae family. It comes from central Asia and it has been cultivated for 5000 years. In the Middle Ages, people used the seeds as food and the fibers to weave clothes. Now, flaxseed is used in some multigrain breads and bakery products.

Flaxseed contains many potential allergens. In a recent case study of linseed (flaxseed) hypersensitivity, Alonso *et al.*¹³ found five allergens with molecular weights of 38, 35, 30, 22 and 20 kDa by sodium dodecyl sulfate–polyacrylamide gel electrophoresis (SDS-PAGE) immunoblotting. In contrast, by SDS-PAGE immunoblotting under non-reducing conditions, Lezaun *et al.*¹⁴ found that allergens with a higher molecular weight (150–175 kDa)

Table 1 Test results

Test substance	Prick test	RAST classes
Pollen		
Alder	++	1
Hazel	++	1
Birch	+++	2
Rye	++++	3
Grasses	++++	3
Nuts		
Hazelnuts	++	0
Walnuts	+	0
Almonds	+++	0
Ingredients of wholemeal roll		
Flaxseed	+++	2
Sunflower kernels	Negative	0
Sesame	Negative	0
Rye flour	Negative	0
Wheat flour	Negative	0
Soybean flour	Negative	0
Malt flour	Negative	0
Baker's yeast	Negative	0
Margarine	Negative	ND
Buttermilk	Negative	ND
Controls		
NaCl 0.9%	Negative	
Histamine 0.1%	+++	

RAST, radioallergosorbent test; ND, not done.

intensely bound with IgE and other, more discrete, bindings were noted with lower molecular weight allergens (90–100 kDa). With SDS-PAGE immunoblotting under reducing conditions, the high molecular weight bands disappeared and discrete bands of lower molecular weight (35–100 kDa) were detected. This may suggest that allergens of high molecular weight that bind intensely with IgE separate into various subunits under reducing conditions.

Lezaun *et al.*¹⁴ performed the skin prick test with flaxseed and also with additional cereals. Whereas flaxseed gave a strong positive reaction, the cereals were negative. In the present case, skin prick tests with different flower sorts also gave negative results. Thus, cross-reactivity between flaxseed and other cereals could not be detected. However, Muthiah *et al.*¹² demonstrated significant cross-reactivity between flaxseed and walnut by ELISA inhibition studies. In our patient, walnuts were positive by skin prick testing, yet specific IgE to walnuts failed to be detected by RAST.

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