

Exercise-Induced Anaphylaxis after Ingestion of Sandwich with Soy Containing Canned Tuna: Case Report

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SUMMARY We report a case of a 17-year-old female adolescent who experienced an episode of exercise-induced anaphylactic reaction following ingestion of tuna sandwich (from soy containing canned tuna). Her medical history revealed that she had previously had one episode of urticaria after ingestion of sulfamethoxazole with trimethoprim and anaphylactic reaction after ingestion of sunflower nuts. Skin prick tests and specific immunoglobulin E antibody to tuna were negative, and to soy were positive. Treadmill exercise induced test in fasting state and 1 hour after a fresh tuna meal and meal not containing soy were negative. However, an exercise challenge test one hour after soy ingestion resulted in pruritus of hands, shoulders and back, urticarial lesions of the face and neck with angioedema of the lips and eyelids, hoarseness, tachycardia and anxiety.

KEY WORDS: adolescent, exercise-induced anaphylaxis, soy, tuna

INTRODUCTION

Food-dependent exercise induced anaphylaxis (FDEIA) is a subtype of exercise-induced anaphylaxis induced by specific food (1-3). Maulitz *et al.* were the first to describe exercise-induced anaphylactic reaction to shellfish in 1979 (4). Since then, there have been many reports of FDEIA associated with buckwheat, pistachios, apples, oranges, corn, mushrooms and celery (5-11). The most common food implicated in FDEIA is wheat and molecular studies have identified sequential epitopes in the repetitive domain of wheat gliadins that are bound by IgE antibodies in wheat-dependent EIA (12,13). Previous studies showed males to be twice as likely to be affected compared to females (14). Also, young adults and adolescents are more affected than children below age 10 (14). FDEIA due to soybean is a rare disorder and it is

suggested that the presence of undigested allergens in the digestive tract is a prerequisite for the development of FDEIA (15). We report on a patient who developed FDEIA to soy after ingestion of canned tuna. The cases of soy dependent EIA are rare.

CASE REPORT

A 17-year-old female experienced anaphylactic symptoms (pruritus of hands, shoulders and back, urticarial lesions of the face and neck with angioedema of the lips and eyelids, hoarseness, tachycardia and anxiety) during basketball training 1.5 h after consuming a tuna sandwich. She was treated with intravenous corticosteroids and peroral antihistamines, and recovered in one hour. The serum tryptase level was normal. She had a history of urticarial lesion to

sulfamethoxazole with trimethoprim and aspirin. Open-label challenge test was negative to sulfamethoxazole with trimethoprim and positive to aspirin. Furthermore, she also had experienced anaphylactic reaction (nausea, vomiting and rush) after eating sunflower nuts. By then, she had drunk soy milk and eaten soy products without adverse reactions.

On admission, 1 month after initial anaphylaxis, physical examination revealed no significant findings. Skin prick tests with additives and food allergens were positive to soy (7 mm). The size of the wheal to histamine was 5 mm. Total IgE antibody was 130.0 kU/L and specific IgE antibody to soy was 0.43 kU/L. Specific IgE antibody to tuna was negative. Open-label oral challenge test with fresh tuna, canned tuna and soy failed to induce any allergic reaction. Treadmill exercise induced test in fasting state using standard Bruce protocol was also negative. After that, we performed treadmill exercise induced test 60 minutes after fresh tuna ingestion and it was negative. Treadmill exercise induced test 60 min after soy ingestion was positive. The patient developed urticaria, tachycardia and pruritus. We treated her with intramuscular injection of epinephrine and corticosteroids and she recovered after 3 hours. The patient was advised to avoid taking soy and soy containing products before exercise. Additionally, self-injectable epinephrine and antihistamines for crisis management were prescribed. She has not experienced another episode since.

DISCUSSION

A case of female adolescent with exercise induced anaphylaxis due to soy protein in canned tuna is presented. FDEIA was confirmed on the basis of positive treadmill exercise induced test 60 min after soy ingestion. FDEIA caused by soy protein is very rare and it is very likely underdiagnosed (15). Many products contain soy protein, yet soy is not listed on their ingredients labels. In our case, canned tuna with vegetable broth contained soy protein.

Two possible hypotheses concerning the pathophysiology for FDEIA have been proposed. Gut permeability is one factor that may play an important role in the development of FDEIA (16). An animal study by Yano *et al.* using lysozyme-sensitized mice revealed that exercise increased the gastrointestinal absorption of lysozyme ingested prior to activity (17). Sensitized mice were found to have a greater number of mucosal lesions in small intestine after exercise than sensitized mice at rest or unsensitized mice, although the mechanism of mucosal damage was not addressed. The authors have noted that exercise can cause significant decreases in mesenteric blood flow

and that intestinal ischemia is linked to increased bacterial translocation and absorption of endotoxin from the gastrointestinal tract.

Another factor hypothesized to be involved in the pathophysiology of FDEIA is tissue transglutaminase (tTG) activity beneath gastrointestinal epithelium (16). Palosuo *et al.* showed that omega-5 gliadin-derived peptides were cross-linked by tTG, causing a marked increase in IgE binding both *in vitro* and *in vivo*. Activation of tTG during exercise in patients with wheat-dependent exercise-induced anaphylaxis (WDEIA) could lead to the formation of large allergen complexes capable of eliciting anaphylactic reactions (18). Moreover, tTG activity can be stimulated during exercise by higher circulating levels of tumor necrosis factor α , interleukin-6, and glucocorticoid hormones produced by skeletal muscle contraction (18). Activated tTG and increased modification of food-derived peptides may lead to more IgE cross-linking and mast cell degranulation. Whether tTG acts on other food substrates besides gliadin is yet to see.

Also, an important consideration in FDEIA is a dose-dependent effect of food allergen on precipitating allergic reaction (19). Furthermore, some medications can influence the onset of FDEIA. Several Japanese studies found aspirin to potentiate FDEIA (12,20,21). Matsuo *et al.* demonstrated that aspirin intake increased blood gliadin levels in WDEIA patients, suggesting that aspirin use may enhance absorption of allergen from gastrointestinal tract in these patients (12). They also showed correlation between circulating levels of gliadin and WDEIA symptomatology, supporting the belief that FDEIA is dose-dependent.

In our case, the patient had a history of aspirin induced allergy, but aspirin had not been consumed for years.

FDEIA must be distinguished from cholinergic urticaria and exercise-induced anaphylaxis (22). The diagnosis of FDEIA should be based on medical history, symptom diaries, elimination diets, screening for potential food allergens by skin prick tests, determination of specific IgE antibody to the suspected food and double-blind food challenges associated with exercise (23,24).

Complete avoidance or at least avoidance of identified food allergen for four hours before physical exercise is an effective method of prevention in children diagnosed with FDEIA.

Moreover, patients should carry an epinephrine autoinjector. Sodium bicarbonate, disodium cromoglycate, and terfenadine are reported as prophylactic agents for FDEIA, although they are not approved



(25-27). Therapy of acute attack includes antihistamines, corticosteroids, and/or epinephrine.

CONCLUSION

FDEIA to soy is a very rare disorder. In cases of unexplained anaphylaxis, FDEIA should be considered, as reactions can occur several hours after ingesting the culprit food. In accordance with the Asthma and Allergy Foundation of America, soy is one of the nine most common food allergens and can be hidden in many foods (28). According to the currently increased awareness of physical exercise and increased consumption of foods containing soy proteins, the incidence of FDEIA caused by soy proteins could be expected to rise.

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