

Case Report

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Food-Dependent Exercise-Induced Anaphylaxis: A Case Report

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Abstract

Food-dependent exercise-induced anaphylaxis (FDEIA) is a rare but potentially fatal condition in which anaphylaxis occurs during or after exercise following consumption of specific trigger foods, often in the presence of additional cofactors. We report a case of FDEIA in a 16-year-old Chinese boy with a history of pollen allergy. He presented with gradual facial itchiness and swelling while taking a warm shower followed by a persistent irritative cough, chest tightness and dyspnea after consuming sourdough bread, and engaging in exercise earlier. He was treated with intravenous Chlorpheniramine and Hydrocortisone, with a good clinical response. An Epinephrine autoinjector was prescribed and comprehensive allergen testing were conducted at a specialist clinic. As FDEIA relies heavily on a suggestive clinical history, early recognition and prompt management are crucial to prevent recurrent and potentially life-threatening events.

Keywords: Anaphylaxis; Exercise; Exercise-induced allergies; Food Dependent; Food Hypersensitivity.

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INTRODUCTION

Allergic reactions are immune-mediated responses to otherwise harmless substances known as allergens, including foods, medications, and environmental agents. Hypersensitivity reactions are classified into four types (I–IV), with Type I hypersensitivity being an immediate immunoglobulin E (IgE)-mediated reaction responsible for most allergic conditions, including anaphylaxis. Food-Dependent Exercise-Induced Anaphylaxis (FDEIA) is a rare form of Type I hypersensitivity in which anaphylaxis occurs only when ingestion of a specific food is followed by exercise or other cofactors.^{4,5,9} Patients typically tolerate the food and exercise independently, making diagnosis challenging. The condition is thought to involve exercise-induced increased gastrointestinal permeability, enhanced allergen absorption, and mast cell activation leading to systemic allergic reactions.^{4,8,9} Wheat is the most commonly implicated trigger worldwide, particularly in Asia, with omega-5 gliadin identified as the major allergen.^{2,4} Other triggers include nuts, seafood, chickpeas, and rice bran.^{1,6} Clinical features range from urticaria and angioedema to severe anaphylaxis involving respiratory and cardiovascular compromise.^{4,6,9,10} Diagnosis is mainly clinical, supported by specific IgE testing, while provocation testing is rarely performed due to risk.^{2,4,9} Management includes immediate intramuscular epinephrine and long-term avoidance of food–exercise combinations.^{4,5,7}

Case presentation

We report the case of a 16-year-old Chinese Canadian boy with a history of pollen allergy and no prior history of wheat allergy, wheat intolerance, or previous wheat-related allergic reactions. He presented with the acute onset of facial pruritus, flushing, angioedema, and respiratory symptoms.

On the day of presentation, he consumed homemade sourdough bread containing wheat. Approximately 40 minutes later, he performed moderate-intensity treadmill exercise for about 30 minutes, followed immediately by a warm shower. During showering, he developed progressive facial itching, erythema, and swelling, followed by cough, chest tightness, and shortness of breath, prompting medical review.

On arrival, he was hemodynamically stable, with a blood pressure of 118/89 mmHg, a pulse rate of 98 beats/min, and an oxygen saturation of 97% on room air. He had persistent facial flushing and angioedema and complained of difficulty in breathing. Physical ex-

amination revealed only cutaneous manifestations. He was not in respiratory distress, and lung auscultation demonstrated normal breath sounds. Laboratory investigations, including a complete blood count, liver function tests, and a renal function profile, showed no clinically significant abnormalities. The absolute eosinophil count was 0.1×10^9 L, which was within the normal range.

The patient was treated with a stat dose of intravenous hydrocortisone (200 mg) and intravenous chlorpheniramine (10 mg), together with supplemental oxygen, due to complaints of breathlessness and tachypnoea. Despite these symptoms, his oxygen saturation remained at 97% on room air, and respiratory examination revealed normal breath sounds bilaterally without wheeze or stridor.

Following treatment, his cutaneous manifestations improved markedly, and his dyspnea resolved. He remained hemodynamically stable throughout a 2-hour observation period, with no recurrence or progression of symptoms. He was discharged with oral chlorpheniramine 4 mg nightly, loratadine 10 mg once daily, and prednisolone 20 mg twice daily for 7 days.

He was referred to a specialist allergy clinic, where allergen testing demonstrated sensitisation to wheat, cereal grains, fruits (including peach), pollens, and animal dander. A diagnosis of probable food-dependent exercise- and heat-induced anaphylaxis was made based on the temporal association between wheat ingestion, exercise, heat exposure, and symptom onset. He was commenced on levocetirizine 5 mg once daily for 3 months, daily sublingual.

DISCUSSION

FDEIA is uncommon but should be considered in patients with anaphylaxis occurring after combined food intake and exercise. Although it mainly affects young adults, it can also present in adolescents, as seen in this case. Current prevalence data are limited; however, a Japanese study reported an estimated prevalence of 0.0117% among adolescents, indicating its rarity.^{10,15}

Wheat is the most frequently implicated food trigger of food-dependent exercise-induced anaphylaxis (FDEIA), particularly in adults.^{2,4,9} In this patient, symptoms occurred after ingestion of wheat-containing bread, followed by exercise and a hot shower. While wheat ingestion and exercise are the established primary triggers, heat exposure from the subsequent hot shower may have acted as an additional cofactor by

increasing core body temperature and lowering the threshold for anaphylaxis.¹⁴ Sensitisation to wheat on allergy testing further supported the diagnosis. Wheat-dependent exercise-induced anaphylaxis (WDEIA) is also recognized as one of the most common phenotypes of FDEIA in Western populations.¹⁵

Omega-5 gliadin is recognised as the major allergen in wheat-dependent exercise-induced anaphylaxis.^{2,4} Specific Ig-E testing (e.g. ImmunoCAP) has good diagnostic performance, with sensitivity up to 80% and specificity around 96%. Other wheat proteins, including high- and low-molecular-weight glutenin subunits and α -, β -, and γ -gliadins, may also contribute to disease expression. In omega-5 gliadin-negative cases, sensitization to non-gluten allergens such as Tri a 14 and hydrolyzed wheat protein has been described.^{2,13}

The pathophysiology of food-dependent exercise-induced anaphylaxis (FDEIA) remains incompletely understood. During exercise, redistribution of blood flow from the gastrointestinal tract to skeletal muscles may result in transient intestinal ischaemia, increasing gastrointestinal permeability and facilitating greater absorption of food allergens into the circulation.^{4,8,9} This process may also explain the abdominal discomfort or cramps commonly experienced by some patients who exercise after eating. Increased allergen absorption subsequently triggers systemic mast cell activation, resulting in the release of mediators including histamine, tryptase, and leukotrienes.^{4,8,9}

Cofactors play an important role in disease expression by lowering the threshold for anaphylaxis. In this case, heat exposure from a hot shower following exercise may have acted as an additional cofactor. Other recognised cofactors include NSAIDs, alcohol, infections, and temperature changes, which may synergistically enhance mast cell activation.¹⁴ Experimental studies have further demonstrated that exercise, in combination with cofactors such as aspirin, increases circulating gliadin peptide levels, supporting the role of enhanced allergen absorption in FDEIA.¹² In addition, transglutaminase-mediated modification of omega-5 gliadin enhances Ig-E binding, thereby increasing its allergenicity.¹³

Clinically, FDEIA ranges from mild cutaneous symptoms to severe systemic anaphylaxis with respiratory compromise.^{4,6,9} This patient developed both cutaneous and respiratory symptoms, fulfilling diagnostic criteria for anaphylaxis despite stable vital signs.^{4,7}

Diagnosis like any other allergic reaction is primarily clinical and based on the temporal relationship between

food intake and exercise.^{2,4,9} Provocation testing is the gold standard but is rarely performed due to safety concerns. In this case, the diagnosis was supported by clinical history and sensitisation testing which show positive result for wheat, cereal grain, group of fruits and pollen.¹⁴

The patient was treated with oxygen, intravenous fluids, hydrocortisone, and chlorpheniramine, with subsequent clinical improvement. Current guidelines from the World Allergy Organization and the American Academy of Allergy, Asthma & Immunology recommend prompt intramuscular epinephrine as the first-line treatment for anaphylaxis and advise that its administration should not be delayed when anaphylaxis is suspected.^{7,9,10} Antihistamines and corticosteroids should be used only as adjunctive therapy, while supportive care and close monitoring remain essential. Long-term management of FDEIA includes avoidance of the culprit food before exercise, avoidance of identified cofactors such as heat exposure and NSAIDs where applicable, patient education on trigger avoidance, and provision of an epinephrine auto-injector for emergency self-administration.^{2,4,7}

CONCLUSION

FDEIA is a rare but potentially life-threatening condition requiring a high index of suspicion. This case highlights wheat-dependent exercise- and heat-induced anaphylaxis triggered by combined food ingestion, exercise, and heat exposure. Early recognition, prompt intramuscular epinephrine administration, and avoidance of trigger combinations remain essential for prevention of recurrence and favourable outcomes.

Take Home Message

- Wheat-dependent exercise- and heat-induced anaphylaxis should be considered in patients with recurrent anaphylactic episodes occurring after wheat ingestion followed by exercise, particularly when wheat ingestion alone is tolerated.
- Heat exposure, including a hot shower after exercise, may act as an additional cofactor that lowers the threshold for anaphylaxis and should be considered during clinical assessment.
- The differential diagnosis includes exercise-induced anaphylaxis, isolated IgE-mediated wheat allergy, cholinergic urticaria, and idiopathic anaphylaxis; a detailed clinical history demonstrating the relationship between food intake, exercise, and cofactors is essential for diagnosis.
- Management requires prompt recognition and treatment of anaphylaxis with intramuscular epinephrine when indicated, followed by long-term strategies including avoidance of culprit foods before exercise, identification of cofactors, patient education, and provision of an epinephrine auto-injector.

List of Abbreviations

AAAAI	American Academy of Allergy, Asthma & Immunology
EIA	Exercise-induced anaphylaxis
FDEIA	Food-dependent exercise-induced anaphylaxis
GI	Gastrointestinal
IgE	Immunoglobulin E
IM	Intramuscular
NSAIDs	Non-steroidal anti-inflammatory drugs
SLIT	Sublingual immunotherapy
WAO	World Allergy Organization
WDEIA	Wheat-dependent exercise-induced anaphylaxis

Declarations

Ethics approval and consent to participate

Ethical approval was not required for this single case report according to institutional policy. Consent was obtained from the patient and/or legal guardian.

Consent for publication

Written informed consent was obtained from the patient and/or legal guardian for publication of this case report and accompanying clinical information.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

All authors contributed to the clinical care, data collection, manuscript preparation, and revision. All authors approved the final manuscript.

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