
Case report

Anaphylaxis to wheat beer

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Background: Despite its worldwide and abundant consumption, beer has rarely been found to cause anaphylaxis. Barley malt contained in lager beers seems to be an important elicitor.

Objective: To report the unusual case of severe anaphylaxis following the ingestion of wheat beer.

Methods: A 59-year-old man experienced angioedema, generalized urticaria, and unconsciousness after ingestion of wheat beer. He tolerated lager beer well. For diagnostic evaluation, skin prick tests, oral challenge tests, and identification of specific IgE antibodies were performed.

Results: Skin prick test results with standard series of common aeroallergens and food allergens were negative with the exception of a 1+ reaction to wheat flour. The results of skin prick tests with native materials were positive for 2 brands of wheat beer and wheat malt shred but negative for baker's yeast, hops, and a brand of lager beer. Oral challenges with wheat beer or wheat flour elicited urticaria. By CAP-FEIA, specific IgE antibodies to wheat and barley flour but not to hops or baker's yeast were found in serum. Immunoblot analysis revealed that patient's IgE was bound to a protein of approximately 35 kDa in wheat extract.

Conclusions: This is the first report, to our knowledge, on anaphylaxis to beer attributable to wheat allergy.

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INTRODUCTION

According to Germany's oldest foodstuff law, originating from the so-called Bavarian Purity Law issued by Duke Wilhelm IV of Bavaria in 1516, beer may contain only barley, hops, and water. Malt is obtained by heating or roasting germinated barley. It lends beer its richness of flavor and its color. Malt for specialty beers can also be made from other cereals. Hops provides the distinctive bitter aroma of beer. Yeast supplies the fermentation that gives rise to alcohol and carbon dioxide. Yeast was present as a contaminant in the old days of brewing and therefore unmentioned in the purity law; today it is also added intentionally.

Beer is the most abundantly consumed alcoholic beverage throughout the world, and it is usually well tolerated when enjoyed in moderate amounts. There have been only a few reports of hypersensitivity reactions to beer. When the cereal component was the cause of the reaction, barley malt was found to contain the precipitating allergens in all cases. Wheat beer is a Bavarian specialty beer that is brewed from both barley and wheat malt. We herein describe a patient with an anaphylactic reaction to beer that was caused by allergy to wheat.

CASE REPORT

History

A 59-year-old patient developed angioedema and generalized urticaria 3 hours after ingestion of 1.5 L of Gögginger Wei-

zen wheat beer and 1 pretzel. One month later, he was admitted to the hospital because of a more severe reaction that presented as generalized pruritus, urticaria, and a short period of unconsciousness. Symptoms started while the patient had been golfing for 30 minutes after having drunk 1.0 L of wheat beer (Erdinger Premium Weißbier). The patient had no history of atopic disease or previous anaphylactic reactions. Wine, lager beers, pastries, and bread were well tolerated.

Allergological Evaluation

Immediate-type skin prick test reactions to a standard series of common aeroallergens and food allergens were negative with the exception of a 1+ reaction (wheal diameter 2 mm) to wheat flour. Particularly, there was no reaction to barley flour. For further skin prick tests, native beers were used undiluted and solid materials were suspended in saline. A 3+ reaction (wheal diameter >4 mm) developed in response to 2 brands of wheat beer (Erdinger Premium Weißbier and Paulaner Weissbier Kristallklar), a 2+ reaction (wheal diameter 3 mm) occurred to wheat malt shred, and a 1+ reaction was observed to barley malt shred. The results of control skin prick tests with these materials in 10 healthy volunteers were negative. Histamine dihydrochloride (0.1%) served as the positive control and elicited a 3+ reaction in the patient. There were no reactions to further native material (ie, yeast, hops, and a brand of lager beer [Augustiner Helles]) (Fig 1).

Assessment of the patient's serum by CAP-FEIA (Pharmacia, Uppsala, Sweden) revealed specific IgE antibodies to wheat flour (CAP class 3; concentration, 4.96 kU/L), barley flour (CAP class 2; 1.21 kU/L), and barley malt (CAP class 2; 1.47 kU/L) but not to hops or baker's yeast (*Saccharomyces*

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Figure 1. Skin prick test reactions on the ventral aspect of the patient's forearm with 2 wheat beers (top, Erdinger Premium Weißbier; middle, Paulaner Weissbier Kristallklar) and 1 lager beer (bottom, Augustiner Helles).

cerevisiae). By immunoblot analysis (DPC Biermann, Bad Nauheim, Germany), binding of specific IgE antibodies to a protein of approximately 35 kDa in wheat extract could be found. No further characterization of this protein was performed. Oral challenge tests were performed with incremental doses, given 2 hours apart, of wheat beer (Erdinger Premium Weißbier) or wheat flour suspended in water, respectively. The patient developed wheals on his face 4½ hours after the last intake of a cumulative amount of 1.6 L of wheat beer, administered at doses of 0.1, 0.5, and 1.0 L. Similarly, wheals appeared 15 minutes after the ingestion of a total of 120 g of wheat flour (20/100 g). The patient did not consent to further oral challenge testing with barley or rye flour.

DISCUSSION

Our patient experienced severe anaphylactic reactions after drinking wheat beer. The results of in vivo and in vitro tests

revealed that his hypersensitivity was mediated by specific IgE antibodies against wheat allergens. The patient also had specific serum IgE antibodies to barley flour, but these were evidently of no clinical relevance, since beers solely based on barley malt (lager beers) were tolerated without problems.

The diagnosis of anaphylactoid reactions to ethanol-containing beverages can be difficult, since, apart from alcohol itself, various ingredients have to be considered, such as the cereal or vegetable raw material, yeasts, molds, preservatives, and coloring or flavoring ingredients.¹ An important differential diagnosis in the case of alcohol-induced anaphylactoid reactions is symptoms induced by the use of disulfiram or drugs that similarly interfere with the metabolism of ethanol. Such reactions also occur in certain ethnic groups due to genetic variations of alcohol-metabolizing enzymes.

In the few reported cases of true allergic reactions to the cereal component of beer, invariably barley malt was identified as the source of the allergens. Systemic anaphylactic reactions to barley malt in beer seem to be rare and have been reported, to the best of our knowledge, in only 6 patients.²⁻⁶ Another manifestation of such hypersensitivity reactions was contact urticaria, mostly of the oral mucosa.^{4,6-8} By immunoblotting with patients' IgE, proteins of 44.1 kDa and between 31 and 56 kDa were characterized in barley malt as the probable allergens. A strong IgE-binding, 38-kDa band was identified in beer extract,^{2,9} and smaller bands of 10 and 16 kDa were found in beer and barley.^{2,5} The 10-kDa protein likely represents a lipid transfer protein and may account for cross-reactivities to beer and a broad spectrum of other food, such as peach, apple, peanut, corn, and rice.^{6,7}

Compared with respiratory wheat allergy (baker's asthma), allergic reactions to oral ingestion of wheat are rare. However, wheat allergy is one of the most frequent causes of food-dependent, exercise-induced anaphylaxis in adults.¹⁰ Although the IgE response in baker's asthma is directed mainly toward water-soluble proteins, the alcohol-soluble gliadins and the acid/alkali-soluble glutenins seem to be primarily responsible for allergy due to ingestion of wheat. Our patient developed anaphylactic reactions in response to wheat beer but not to wheat-based pastries or bread. However, a reaction to wheat flour could be elicited in an oral challenge test with wheat flour in the absence of physical exercise, demonstrating that a sufficient amount of allergen can be absorbed from wheat flour when large amounts are ingested. With regard to the rather severe reactions reported by the patient, it seems likely that the combined ingestion of wheat and ethanol from wheat beer and concomitant exercise while golfing had enhanced reactivity. In the serum of our patient, we identified IgE antibodies binding to a 35-kDa protein in wheat flour extract. Similarly, in the serum of 2 patients with wheat-dependent, exercise-induced anaphylaxis, a 36-kDa IgE-binding protein has been found by immunoblots, which was identified as wheat γ -gliadin.¹¹

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Erratum

In the CME review article “Antihistamines and driving ability: evidence from on-the-road driving studies during normal traffic” (*Ann Allergy Asthma Immunol*. 2004;92:294–304), the authors, Joris C. Verster, PhD, and Edmund R. Volkerts, PhD, stated that for mizolastine, “after 4 days of treatment, no significant effects were observed on driving ability” (page 299). This was also stated in Table 3 on page 298. Unfortunately, this is not correct: mizolastine has not been studied after repeated administration. The authors regret the error.
