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CASE REPORT/OLGU SUNUMU

A Baker with Asthma and Wheat Flour Food Allergy

Astımı ve Buğday Unu Gıda Allerjisi Olan Bir Fırıncı

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ABSTRACT

Patients with wheat flour food allergy and with baker's asthma are not sensitised to wheat pollen, despite the fact that they share some common allergens. In the same way, asthmatic bakers tolerate the ingestion of bread. The difference in sensitisation routes (inhalation versus ingestion) and allergenic source (wheat flour versus processed wheat foodstuffs) could explain this fact, although some wheat allergens, like α-amylase inhibitors, lipid transfer proteins and gliadin are implicated in both types of allergy. We report the case of a 45-year-old male who worked in a bakery for 30 years as a baker. He was confirmed to have occupational asthma, rhinitis and food allergy due to wheat flour.

Key words: Baker's asthma, wheat allergens, food allergy, lipid transfer proteins, alpha-amylase inhibitors, gliadin

ÖZ

Bazı ortak allerjenleri paylaşmalarına rağmen fırıncı astımı olan ya da buğday unu ile gıda allerjisi olan hastalarda buğday polenine karşı duyarlılık saptanmamaktadır. Aynı şekilde, fırıncı astımı olan hastalar buğday ununda yapılmış ekmeği sorunsuzca tüketebilmektedir. Bu durum duyarlanma yollarının (inhalasyona karşı sindirim) ve allerjenik kaynakların farklılığı (buğday ununa karşı buğdaydan yapılmış gıda ürünleri) gibi nedenlerle açıklanabilmektedir. Fakat her iki tip allerjiden sorumlu olabilen α-amilaz inhibitörleri, lipid transferaz proteinleri ve gliadin gibi bazı buğday allerjenleri olduğu da bilinmektedir. Biz burada, 30 yıldır fırıncı olarak çalışan 45 yaşındaki bir erkek hastada buğday ununa bağlı fırıncı astımı, riniti ve gıda allerjisi gelişen bir olguyu sunuyoruz.

Anahtar kelimeler: Fırıncı astımı, buğday allerjenleri, besin allerjisi, lipid transfer proteinleri, alfa-amilaz inhibitörleri, gliadin

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INTRODUCTION

Proteins represent about 10%-15% of wheat grain and can be classified in 2 different fractions as salt-soluble proteins (albumins and globulins) and salt-insoluble proteins (prolamins namely gliadins and glutenins). Salt-soluble proteins including cereal α-amylase inhibitors, peroxidase, thioredoxin, nonspecific lipid transfer protein (LTP), serine proteinase inhibitor, and thaumatin-like protein as well as salt-insoluble proteins consisting of gliadins and glutenins are known to be allergens associated with baker's asthma (1). More than 100 IgE-binding protein spots have been detected in wheat flour and sera from sensitized bakers show not only reactions to many of these antigens but also considerable variability in individual sensitization patterns (2). A wide array of wheat flour proteins, both salt-soluble proteins and prolamins, and particularly members of the α-amylase inhibitor family and ω5-gliadin (in wheat-dependent exercise-induced anaphylaxis), have been linked to food wheat allergy (2-4). LTPs have (wheat flour Tri a 14) recently been identified as a relevant allergen associated with both baker's asthma and wheat IgE-mediated food allergy (3-6). Several of the major salt-insoluble wheat flour proteins (prolamins) such

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as gliadin also appear to be implicated in baker's asthma and wheat mediated food allergy (7).

This report describes the assessment of a case of Baker's asthma accompanied with gastrointestinal symptoms after ingestion of bread made from wheat flour. Possible causative wheat allergens were discussed with review of the relevant literature.

CASE REPORT

We report the case of a 45-year-old man who had been working in a bakery for 30 years as a baker. Initially he was free of symptoms, but 10 years later he presented with rhinoconjunctivitis. He remained asymptomatic during weekends and holidays. He had symptoms (diarrhea and abdominal discomfort) on ingestion of bread made from wheat flour. The patient was diagnosed as baker's rhinitis in our clinic 16 years ago. Specific challenge to wheat flour (tidal breathing method) had elicited an early severe rhinitis response. Wheat flour specific IgE was found to be positive. At that time, he had no asthma symptoms. Approximately twenty years after joining the pastry shop he developed asthma symptoms and since that time he has been on bronchodilators and inhaled steroids. He admitted to our clinic for further assessment of his rhinoconjunctivitis and asthma. He was still working as a baker. He had quit smoking 16 years ago. He had no other known medical diseases and was not using any other medication. On physical examination, the patient appeared healthy and well nourished with blood pressure of 120/80 mmHg, respiratory rate of 18/min, heart rate of 70/min, and arterial oxygen saturation of 96%. Blood cell count, biochemistry, and chest radiographs were all normal. Skin prick tests (SPT) with commercially available extracts (ALK-Abello, Madrid, Spain), were positive to wheat and rye flour. Antiendomycium antibodies were negative. SPT were negative to *Dermatophagoides pteronyssinus, D. farinae*, cockroach, polen, molds, cat and dog dander, bird feathers and egg. Total serum IgE was 59.3 kU/l. IgE antibodies were detected to wheat flour (24.2 kU/L). Egg yolk (<0.1 kU/L), cacao (<0.1 kU/L), alpha-amylase (<0.1 kU/L), *D. pteronyssinus* (0.14 kU/L), *D. Farinae* (0.12 kU/L), and *Acarus siro* (0.12 kU/L) (CAP Pharmacia, Sweden). Spesifik IgE were negative. Spirometry revealed a forced vital capacity (FVC) of 101%, forced expiratory volume in 1s (FEV1) of 93%, FEV1/ FVC of 74%, and forced expiratory flow (FEF25-75) of 68%. The reversibility test was positive with 15% (580ml) increase in FEV1. A second specific challenge was not performed as this test was positive for his rhinitis 16 years ago. He also reported diarrhea and abdominal discomfort shortly after digestion of bread. Gastrointestinal symptoms disappeared after elimination of bread made from wheat flour from his diet. The patient was advised to eat cornbread and the GIS symptoms did not reappear with the use of this kind of bread.

In summary; GIS sensitivity to wheat flour was shown by SPT, IgE antibody determination, and elimination diet. The occurrence of rhinitis symptoms with exposure to wheat flour was demonstrated in the hospital setting by a specific challenge test. His asthma was thought to be work related according to the history, serial PEF monitoring and sensitivity to wheat flour. The diagnosis in this baker was occupational rhinitis, a high possibility of occupational asthma, and wheat flour food allergy.

DISCUSSION

Wheat food allergy in adult patients has been considered a minor and rare IgE mediated hypersensitivity, in contrast with baker's asthma, noticed as an important occupational disease among bakery workers. However, an increasing number of adult patients with food allergy to wheat flour-derived products have been reported in recent years (5). On the other hand most of the patients with baker's asthma in different surveys did not present with wheat food allergy (8,9). It is common knowledge that bakers with occupational asthma can usually consume bread and wheat-derived foodstuffs all their life without any problem. Our case was interesting because he had both respiratory and GIS symptoms due to wheat flour allergy.

There are several potential sensitizers in the baker's environment, including wheat, rye, barley, baking enzymes, molds and eggs. Wheat flour appears to be the dominant sensitizer in most bakeries. Our patient was sensitive to wheat and rye flour but he was not allergic to egg, α-amylase, molds, cockroach and storage mites. A wide array of wheat flour proteins have been linked to allergy, and several of these allergen groups have been involved in baker's asthma. As our patient described gastrointestinal symptoms after ingestion of bread besides his respiratory complaints, the mechanism of development of sensitivity should be different from cases having either baker's asthma or food allergy. A difference in the route of sensitization (inhalation versus ingestion) and allergenic

source (wheat flour versus processed wheat foodstuffs) could explain this fact, although some wheat allergens, like α-amylase inhibitors or LTP, are implicated in both types of allergy (5,10,11). The earlier microarray studies demonstrate that thioredoxin h, glutathione transferase, 1-Cys-peroxiredoxin and dehydrin are mainly recognized by sera from patients suffering from wheat-induced respiratory allergy but not from patients with wheat-induced food allergy (12). Therefore, we do not suspect them as agents that caused our patient's clinical condition. Allergens belonging to the α-amylase inhibitor family have been found in flour proteins implicated in wheat food allergy, thus indicating their capacity to sensitize not only by inhalation (baker's asthma), but also by ingestion (1,13). Tri a 14 , a wheat flour LTP allergen, seems to be exclusively associated with wheat-induced allergy by inhalation having a high diagnostic value (13). In addition, Tri a 14 seems to be a relevant allergen in patients with allergic reaction after ingestion of wheat flour foodstuffs, according to in vitro and in vivo results (11). Therefore wheat LTP and α-amylase inhibitors are among the most possible allergens responsible for gastrointestinal symptoms accompanied by respiratory symptoms in our case. Unfortunately we could not test sensitivity to LPT and α-amylase inhibitors due to the lack of commercial wheat recombinant allergens. Besides the salt-soluble allergens (LTP, α-amylase inhibitors) discussed above, several of the major salt-insoluble wheat flour proteins (prolamins) also appear to be implicated in baker's asthma. Sensitization to natural total gliadin was observed in 33% of the asthmatic bakers (3). However, total gliadin was not measured in our patient. Therefore, the agent that caused the patient's clinical condition might also be gliadin.

Taking the above into account, we think that isolation and characterization of cereal allergens associated with baker's asthma, particularly from wheat flour, enable us to better define major and minor allergens, thus helping to produce an adequate diagnostic panel of molecular markers. This approach is useful to establish potential links between sensitization profiles and clinical symptoms; to compare molecules involved in different routes of sensitization (inhalation versus ingestion); to predict potential cross-reactions with allergens from plant foods or pollens; and to investigate changes in allergenic capacity in cereal (wheat)-derived foodstuffs (1,12,14).

In conclusion, wheat flour proteins such as gliadin, α-amylase inhibitors and LTP should be considered as responsible allergens in patients with both baker's asthma and wheat IgE mediated food allergy. There is a need for characterized recombinant wheat allergens for the development of serological tests that allow the discrimination of the various clinical manifestations of wheat allergy.

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