Ask The Expert

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Baker's Asthma

Question

I continue to see Baker's Asthma in Australia. Often, bakers are exposed to multiple allergens, not just wheat. Sometimes it is difficult to obtain details of all potential allergens. What is the minimum allergen work-up you recommend, both in skin testing, and allergen serology?

Answer

By Prof Brett J Green

Occupational exposure to cereal flour and associated additives has been identified as determinants of allergic sensitization and work-related respiratory symptoms (baker's asthma) among bakery workers [1]. During the last several decades, research has focused on sensitization to wheat (Triticum aestivum) due to the prevalence of this flour in bakery operations [2, 3]. Rye (Secale cereale), barley (Hordeum vulgare), buckwheat (Fagopyrum esculentum), and cereal malt flours are also utilized in bakeries and have been implicated in cases of baker's asthma [1, 4-6]. To date, the role of other commercially available cereals such as maize, rice, sorghum, triticale, millet, and oats as determinants of occupational sensitization among bakery workers requires further clinical evaluation.

More than 30 cereal allergens have been identified, characterized, and submitted to the International Union of Immunological Societies Allergen Nomenclature Committee (http://www.allergen.org). The most prominent allergens reported in cases of baker's asthma belong to the group of α-amylase/trypsin inhibitor family [7]. These proteins are common in wheat, rye, and barley [4, 7-9]. In addition to α-amylase/trypsin inhibitors, other proteins have also been identified to bind worker serum IgE and include thioredoxin, peroxidase, lipid transfer protein, serine protease inhibitor, thaumatin-like protein, gliadins, and glycerinaldehyde-3-phosphate dehydrogenase [4, 7, 10, 11]. To date, Phadia ImmunoCap and microarray technologies such as Phadia's Immuno Solid-phase Allergen Chip (ISAC) have provided new approaches to measure serum specific IgE to individual recombinant and naturally purified cereal and bakery additive allergens [12, 13]. A list of allergens that can be evaluated using these technologies can be referred to in Olivieri et al. [12] and Sander et al. [13].

In addition to cereal flours, other additives such as enzyme-based dough improvers have been identified as respiratory sensitizers in bakeries [1, 6, 14]. Fungal α-amylase derived from Aspergillus oryzae is an enzyme that breaks down starch into simple sugars for yeast during bread proofing [1]. Workers in large scale bakeries that handle bread improvers such as α-amylase, are susceptible to occupational asthma, rhinitis, and other allergic symptoms [15]. In addition to fungal α-amylase, xylanases derived from Aspergillus and Trichoderma species can also be present as an additive to break down high molecular xylans in baking flour to make dough rise faster [16-18]. Other enzymes have also been reported as sensitizers in commercial bakery operations and include cellulase [17, 19], β-xylosidase [20], and glucoamylase [21]. Bacterial enzymes have also been reported and include amylase and amyloglucosidase [22].

Soy (Glycine max) is another common additive used to bleach dough carotinoids [23]. Sensitization to soy has been identified in bakery workers [6, 24] and workers serum IgE has been shown to bind high molecular weight allergens in soybean flour but not Gly m 1 hull allergens associated with community asthma epidemics [23]. Soybean allergens include trypsin inhibitor, lipoxygenase [25] and soybean lecithin [26]. Other high molecular weight protein additives that have been associated with occupational sensitization include egg white [27, 28], egg yolk [1], sesame seed, milk, cacao, chocolate, hazelnut, and almond [1]. Sensitization to insect contaminants including grain weevils [29], storage mites [1], flour beetles [30] and excreta [31] have also been identified among bakery workers. To date, the role of fermentation yeasts (Saccharomyces cerevisiae) and other microbial contaminants such as Alternaria and Aspergillus species requires further clinical evaluation [32-34].

Bakery workers at risk of sensitization include those that are atopic and have job categories that weigh, sieve, and mix ingredients such as dough makers, bread formers, and bread bakers [1, 3, 35-37]. Allergen workups should include wheat, rye, and barley flour extracts as well as a selection of enzyme and protein additives such as fungal α-amylase and soy. The clinician could consider testing additional products used in the workers' specific environment or job category. For example, if the worker suspects exposure to contaminants, one could consider testing a panel of insect (dust and storage mite) and fungal extracts. To date, skin testing and allergen serology extracts are commercially available for many of the additives that are associated with bakery operations. For a more detailed review of important allergens encountered in bakery occupations please refer Houber et al. [1].

The findings and the conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

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