

EDITORIAL

Clinical and
Experimental
Allergy

Maize allergy: what we have learned so far

This editorial discusses the findings of the paper in this issue by Scibilia et al. [11]

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Maize (corn in the USA) is present in a wide range of foods such as breakfast cereals, corn snacks and tortilla chips, polenta, cornflour (widely used in soups and sauces) and a whole range of wheat-free foods.

There are a number of unanswered questions regarding maize allergy. These include the mechanisms and symptoms involved, prevalence in adults and children, allergens involved and clinical cross-sensitization, usefulness of diagnostic tests and management of maize allergy.

It is important to have accurate national data on the prevalence of food hypersensitivity in order to meet the needs of the allergic community, particularly as the prevalence of food allergies vary depending on the diet and exposure to food allergens. The most common foods to cause food hypersensitivity reactions are milk, egg, peanuts, tree nuts, fish and shellfish [1]. Geographical variance in the prevalence of self-reported food hypersensitivity and differences in the foods reported to cause hypersensitivity have been well documented [2–4]. Examples include fish allergy that is frequently seen in Spain [5] and peanut allergy that is common in the USA [6].

Cereals account for about 70% of the world's protein intake and include wheat, spelt, barley, oats, rye, rice, corn, sorghum and millet. Despite this, the prevalence of allergic reactions to most cereals is less well documented. In terms of maize allergy, the prevalence is unknown, although it has been reported to cause severe reactions, particularly in areas where maize is commonly ingested, such as southern Europe and Mexico [7]. A few cases of maize allergy have been reported by Bock [8]. In the UK, a recent Isle of Wight birth cohort study diagnosed only one

child in a cohort of 969 children with challenge-confirmed maize allergy [9].

Cereal allergens include mainly cereal α -amylase and protease inhibitors, cereal prolamins and non-specific lipid transfer proteins (nsLTP). Allergic reactions to maize are linked to an nsLTP [10]. The major allergen of maize, Zea m 14, is an LTP and maintains its structure after cooking at high temperatures [10]. Maize LTP is known to cross-react with the LTP found in other fruits and vegetables (e.g. peach, cherry, barley and rice), and is especially homologous to the peach nsLTP Pru p 3. Maize-allergic patients are therefore not the typical cereal-allergic patient who is seen in wheat allergy (i.e. cross-reactivity to barley and rye). In addition, the increase in the world population puts increasing pressure on agriculture to provide enough food for everyone. This had led to developments in agricultural biotechnology which aim to provide foods with a better quality, improved nutritional content and health attributes, resistance to spoilage, and could even lead to foods with reduced levels of allergenicity, such as insect-resistant corn with genetically modified proteins. The central issue with these developments is defining and characterizing the allergenic potential of the protein involved.

Management of maize allergy, just as with other food allergies, ultimately depends on food avoidance. EU food-labelling laws require that all food products containing wheat, oats, barley or rye declare these on the label, but there is no such requirement for corn at present.

In the current issue of the journal, Scibilia et al. [11] looked at subjects with a history of maize allergy. These patients underwent double-blind, placebo-controlled food challenge (DBPCFC) in order to identify the spectrum of symptoms manifested during challenge, the lowest provocation dose during challenge, and to determine the performance characteristics of maize-skin prick test and specific-IgE tests.

All study participants experienced symptoms of IgE-mediated food allergy, which was reflected in their

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sensitization status. It is important to note that the challenge material in this study was tested for blindness as suggested by Vlieg-Boerstra et al. [12]. The majority of patients developed their allergy to maize as adults. Confirming the data of Venter et al. [13], these authors found that the symptoms reported by the patients were confirmed during the food challenge. However, a history of erythema/pruritus alone was in all cases associated with a negative challenge outcome. This paper therefore does not give an indication of the role of maize in delayed-type food allergies or food intolerance as reported by other studies on wheat [14] and milk [9, 15].

Interestingly, in this study, 77% of challenge-positive patients were grass pollen positive as compared with 64% in the challenge-negative group. This suggests that grass sensitization does not indicate a high likelihood of non-clinical cross-sensitization between maize and grass as often seen with wheat and grass [16]. Cross-sensitization to a large number of fruit and vegetables was also indicated.

This study is the first to give some indication of the sensitivity and specificity of skin prick tests results in diagnosing maize allergy, with 48% of the sensitized patients showing immediate reactions during the DBPCFC. However, no cut-off points suggesting a positive challenge outcome could be determined for maize-specific IgE as previously reported by Sampson and Ho [17] for other foods. The authors did show that the sensitivity of maize-specific IgE (CAP System, Pharmacia Diagnostic, Uppsala, Sweden) was better than that of skin prick tests. It seems therefore that the CAP test may be a useful test for screening patients for possible maize allergy, but both tests were poor predictors of disease when compared with DBPCFC. Due to the homology between the main maize allergen and the peach nsLTP allergen, it may also be prudent where maize allergy is suspected as part of a range of foods causing reactions, to undertake an estimation of specific IgE levels to Pru p 3. Asero et al. [18] showed that those who were likely to have reactivity to non-Rosaceae plants and sensitized to nsLTP were those who had a high level of specific IgE to peach.

Managing maize allergy may cause some practical problems as maize is not considered one of the major food allergens in terms of EU food-labelling laws. This study showed that two of the patients reacted to <100 mg of raw maize and that nearly half of the patients reacted to ≤ 1.6 g of raw maize. This does not, however, give a clear indication on reactivity to cooked maize, although it is mentioned that the major maize allergen is heat stable, or an indication of the dose that may provoke more delayed-type symptoms.

In summary, this paper sheds some light on some of the uncertainties regarding maize allergies. It indicated that maize allergy (IgE mediated) is a problem in southern Europe, with some patients at risk of anaphylaxis. It once again demonstrated the usefulness of the DBPCFC, using validated recipes, in the diagnosis of food allergy. In the

light of reactions to minute amounts of maize in foods, this paper highlights the importance of avoidance strategies and instructions by a qualified dietitian. Finally, more information is needed regarding the use of skin prick tests and specific IgE in diagnosing maize allergy.

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