

MARIA® for Foods

Measuring multiple allergens simultaneously

Early introduction of food allergens to high-risk infants is known to reduce risk of developing food allergies in later life. While this can be done through weaning, there are commercial early introduction foods available. However, the allergen doses of these foods have not been fully established. Dr Martin D. Chapman, Indoor Biotechnologies, has been involved in the development of a modified multiplex array that is able to measure the levels of up to 17 food allergens simultaneously. Using this tool, Indoor Biotechnologies were able to demonstrate the huge variation in commercial allergen products and highlight the need for better guidelines and standardisation.

It is estimated that 1-10% of all adults and children have a food hypersensitivity. In Europe, food allergies affect between 11-26 million people – a statistic that, when extrapolated to the rest of the world, would equate to potentially 240-550 million people with a food allergy.

Food allergies in infants are a major health concern as they can often be life threatening. The incidence of food allergy in toddlers is around 5-8%, compared to 1-2% in adults. This number has increased in recent years, perhaps due to a decrease in childhood exposure to dirt and germs, more pollution or dietary changes.

Early introduction of food allergens, such as peanut and egg, during weaning may help reduce risk of allergy in later life, especially for high-risk babies who may already be predisposed to developing an allergy. These risk factors can include a family history of food allergy and babies who have eczema or existing food allergies, such as cow's milk protein. For low-risk babies, parents are advised to introduce solid foods from around six months of age, including allergenic foods

such as egg and peanut. This can be a daunting task and the more that is known about allergen loads in foods and the responses they may elicit, the better the outcome for child and parents alike.

Dr Martin D. Chapman is President and CEO of Indoor Biotechnologies, a company which provides tests and allergen molecules to help identify and manage allergy and asthma. Indoor Biotechnologies have developed a tool with the ability to simultaneously measure up to 17 specific food allergens from a single sample. The test, called MARIA® for Foods, can be used to measure specific food allergens and can also be applied to industry risk assessments and standardisation of therapeutic products for food allergies.

QUANTIFYING FOOD ALLERGENS

Quantification of food allergens is particularly important for characterising food preparations that may be used for treating and preventing food allergies. The ability to calculate the allergen load of a food is also crucial for food monitoring and to inform risk assessments in the food industry.

Currently, tests tend to be immunoassays which measure the presence or concentration of food proteins through the use of polyclonal antibodies. However, there are limitations to these generic immunoassays, including the need for separate tests for each individual food and their lack of ability to distinguish between all proteins and those specifically known to cause allergic reactions. It is these problems that Dr Chapman seeks to overcome.

CHILDHOOD FOOD ALLERGIES

In 2015, the "Learning Early about Peanut allergy" (LEAP)

study was published. Designed and conducted by the Immune Tolerance Network, this study was the first randomised controlled trial that showed early introduction of food allergens, peanuts in this case, was able to prevent allergy developing.

The researchers enrolled over 600 children at high risk of peanut allergy. The test group were provided with a peanut-containing snack food at least three times a week while the control group avoided peanuts. The results showed that in the control group, 17% of the high-risk infants went on to develop a peanut allergy by age 5. Remarkably, only 3% of the test group developed an allergy by the same age. A follow-on project, the LEAP-ON study, showed that even after a 12-month period of peanut avoidance, children in the test group were still less likely to develop a peanut allergy.

Other studies soon followed suit, with the "Enquiring About Tolerance" study in 2017 reporting reduction in food allergy after introducing peanuts and eggs, but not other high-risk food allergens such as milk, sesame, fish or wheat.

This suggests that previous advice to avoid early introduction to food allergens may have been incorrect and could even have contributed to the increase in food allergies we see today. However, the peanut-based snack used in the LEAP study was previously the only product with a known allergen content proven to be effective against childhood peanut allergy.

Dr Chapman realised that this meant a lack of understanding of allergen loads in other foods, and how they may be impacted by processing techniques or food formulation, for example food powder versus a food puff.

A MODIFIED MULTIPLEX ARRAY FOR FOOD ALLERGENS

Dr Chapman aimed to use multiplex array technology to compare specific food allergen levels in commercial early allergen introduction foods (EIF).

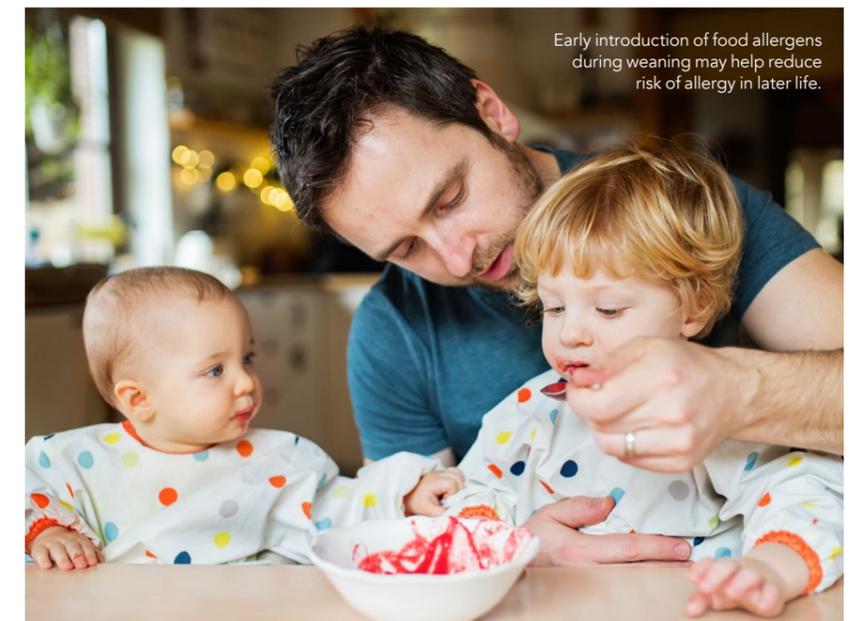


Milk, egg, peanuts and crustaceans are among the most common food allergies.

Multiplex arrays are fast, cost-effective ways to obtain quantitative data about several samples at the same time.

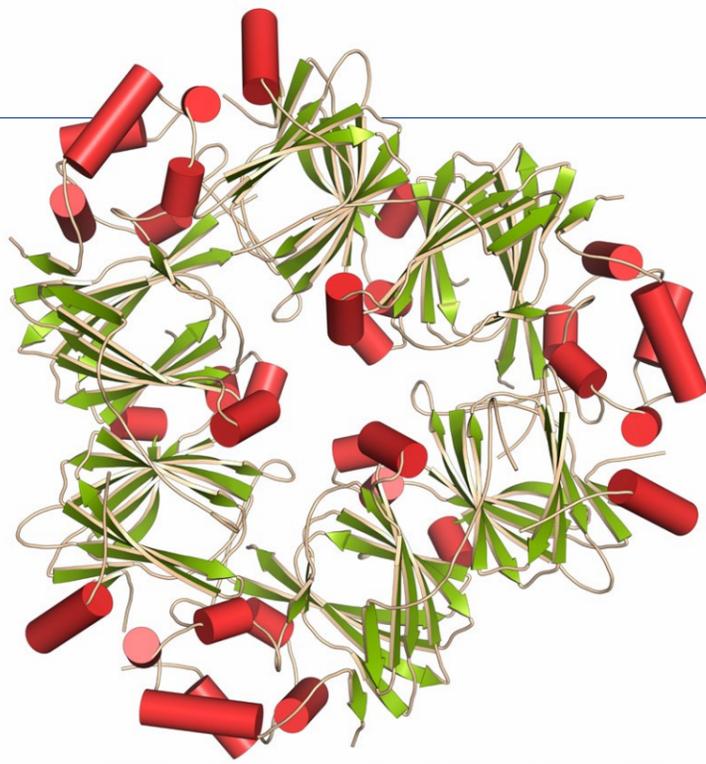
EIF are single or multiple allergen containing foods that are marketed as aids to prevent food allergy in infants. The rapid commercialisation of EIF in the United States has provided consumers and families of high-risk infants with a wide range of EIF that can be used to manage the chance of developing food allergy later in life. Interestingly, EIF may be perceived as drugs or over-the-counter treatments and are expected to show significant benefit. Consumers may also consider EIF for different allergens to be equally effective, whereas in reality there can be much variation in allergen dose and effectiveness of EIF.

The incidence of food allergy in toddlers is around 5-8%, compared to 1-2% in adults.



Early introduction of food allergens during weaning may help reduce risk of allergy in later life.





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Protein Ara h 1 is the main cause for allergic reactions to peanuts.

Using a modified “Multiplex Array for Indoor Allergens” (MARIA) technology, calibrated against purified allergen standards to ensure accurate and reliable results, the researchers were able to compare multiple EIF. The array used antibodies that recognised food allergens to bind to the molecule of interest. These antibodies were coupled to magnetic beads which had unique fluorescent molecules attached. The mean fluorescent intensities of the allergen-antibody-fluorophore complexes was then measured, and the allergen concentration derived through comparison with purified allergens.

A recent study used MARIA® for Foods to compare specific food allergen levels in commercial early introduction foods (EIF). The researchers used extracts from 32 EIF and four control foods to look at levels of 17 different allergens, including soy, peanut, egg, nuts, milk, shellfish, fish, sesame and wheat. The results showed that there was significant variation in the concentration and dose of allergens

in different EIFs from nine different manufacturers. Some EIF had low, or undetectable levels of several allergens. For example, peanut allergen levels up to 26,000 µg/g were found in some peanut puffs, whereas no peanut allergens were detected in mixed food blended puffs.

The highest levels of allergens tended to be found in milk, egg or peanut powders, or a combination of all three. In contrast, mixed food blend powders, puff crackers and fruit sauces contained much lower, and sometimes undetectable allergen loads.

FOOD ALLERGY REGULATIONS

Improved awareness of the doses of major allergens in EIF allows consumers and healthcare professionals to make informed choices about products. Understanding more about how processing impacts the amount of food allergen in a product also helps guide EIF manufacturers in product development strategies.

Dr Chapman calls for guidelines to standardise EIF, and to improve their formulation across the different manufacturers in order to provide better support for children and families with food allergies.

Improved awareness of the doses of major allergens in EIF allows consumers and healthcare professionals to make informed choices about products.

Babies who have eczema or existing food allergies are at a high risk of developing new allergies.



Behind the Research

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Research Objectives

Indoor Biotechnologies has developed MARIA® for Foods, a tool that can simultaneously measure up to 17 specific food allergens from a single sample.

Detail

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Bio
 Dr Martin D. Chapman is President

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Biotechnologies' mission is to improve the quality of life of patients with allergy and asthma.

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References

Filep, S., & Chapman, M. D. (2021). Doses of specific allergens in early introduction foods for prevention of food allergy. *The journal of allergy and clinical immunology: In practice*, S2213-2198(21)00294-4. In Press. Available at: <https://doi.org/10.1016/j.jaip.2021.02.051>



Personal Response

What inspired you to conduct this research?

“ The goal was to measure allergen levels, the ‘active ingredients’, of EIF and see how they compared with Bamba, a peanut puff that is widely used for weaning infants in Israel (where there is a low prevalence of peanut allergy). EIF were effective in preventing peanut allergy in the LEAP study. While several EIF had allergen levels comparable with Bamba, other did not and, therefore, might be less effective for allergy prevention. This is important information for parents and consumers and should allow them to make informed choices about EIF in consultation with their healthcare provider. ”

What is the best way for parents to safely introduce allergens early, whilst still reducing the risks associated with developing a food allergy?

“ Bamba and foods such as smooth peanut butter are approved by guidelines of the U.S. National Institute of Allergy and Infectious Diseases which provide detailed recipes for peanut foods. Some EIF fulfil criteria for a Qualified Health Claim from the US Food and Drug Administration for peanut and are similar in allergen content to Bamba. One EIF contains similar levels of milk, egg and peanut allergens. The EIF powders can easily be mixed with breast milk, milk formula and other baby foods which may be more convenient for parents. ”