International Journal of **Health Science**

EARLY FOOD INTRODUCTION AND FOOD ALLERGY PREVENTION: A NEW EVIDENCE-BASED APPROACH

Maria Eduarda Hygino Portela
University of Vassouras Vassouras - Rio de Janeiro

Júlia da Silva Souza Campos
University of Vassouras Vassouras - Rio de Janeiro

Júlia Ferreira Carrijo dos Santos
University of Vassouras Vassouras - Rio de Janeiro

Maria Clara Lima Igreja
Universidade de Vassouras Vassouras - Rio de Janeiro

Ramon Fraga de Souza Lima
Prof. University of Vassouras Vassouras - Rio de Janeiro

Abstract: This article critically reviews the scientific literature on food introduction and its relationship to food allergy prevention. Based on recent clinical trials and updated guidelines, the paper points to a significant change in pediatric practices, advocating the early introduction of allergenic foods as an effective measure in inducing immune tolerance. Also covered are the role of the gut microbiome, the importance of oral immunotherapy, the risks of prolonged avoidance and the the need for education for caregivers. The data points to the need to integrate science, clinical practice and public policy to ensure an effective, safe and personalized preventive approach. Food introduction, far from being a purely nutritional process, is fundamental for building a healthy and long-lasting immune response.

Keywords: Food allergies; child; development.

INTRODUCTION

In recent years, the guidelines for introducing food in infancy have undergone a real revolution, leaving behind the traditional paradigm of delaying the offer of potentially allergenic foods. This transformation is based on robust scientific evidence that associates the early introduction of certain foods with the prevention of food allergies, representing one of the most significant changes in pediatric practices since the consolidation of exclusive breastfeeding strategies up to six months. The study by Logan et al. (2023), for example, clearly demonstrated that early exposure to peanuts, even in at-risk groups, considerably reduces the incidence of peanut allergies over time (LOGAN et al., 2023).

This change in perspective is supported by the so-called "immune window theory", which suggests that there is a critical period in the first months of life when the immune system is most receptive to the development of immune tolerance. Perkin et al. (2019),

through the EAT clinical trial, showed that this immunological window can be positively exploited through the systematic introduction of allergenic foods, such as eggs, milk and fish, in the first year of life, without increasing the risk of adverse events. This critical window therefore becomes an essential starting point for public policies aimed at preventing allergic diseases in pediatrics (PERKIN et al., 2019).

The consolidation of the effectiveness of early food introduction is also supported by several randomized clinical trials. Kalb et al. (2024), in the TIFFANI study, and Bilaver et al. (2024), in the iREACH project, carried out rigorous planned feeding introduction protocols with children at risk of food allergies. Both studies demonstrated not only the effectiveness of the early approach in reducing food allergies, but also the safety of the method when conducted under clinical guidance. In addition, these studies show that food introduction should not be restricted to one or two foods, but should address a diversity of foods to strengthen immune tolerance (KALB et al., 2024; BILAVER et al., 2024).

Alongside dietary practices, the gut microbiome has been increasingly recognized as a central mediator in immunomodulation. Research such as that by De Filippis et al. (2021) and Bao et al. (2021) has revealed that the composition of the gut microbiota is directly associated with the risk of developing allergic diseases. Children with more diverse and less inflammatory microbial profiles were more likely to develop immune tolerance. Therefore, food introduction should be thought of synergistically with intestinal health, considering that a healthy microbiota can enhance the positive effects of early food exposure (DE FILIPPIS et al., 2021; BAO et al., 2021).

In addition to the direct impact of infant feeding, there are also significant implications associated with maternal feeding and the use of probiotics during pregnancy and lactation.

Shipton et al. (2024), in the OFFSPRING study, demonstrated that maternal supplementation with probiotics can reduce the prevalence of allergic diseases in children by promoting healthier and more balanced intestinal colonization from the first days of life. The importance of the maternal diet therefore becomes a relevant variable in the equation of food introduction and allergy prevention (SHIPTON et al., 2024).

While preventive strategies are gaining ground, the field of oral immunotherapy stands out as a therapeutic approach in cases of established allergy. Studies such as those by Jones et al. (2022) in the IMPACT trial and by Kaushik et al. (2022) on the function of CD8+ T cells indicate that desensitization by gradual exposure to allergenic food can reverse the allergic state in many children. These protocols reinforce the notion that the infant immune system has significant plasticity and that, with appropriate management, it is possible to promote tolerance even after a confirmed diagnosis (JONES et al., 2022; KAUSHIK et al., 2022).

However, a barrier still present in the management of food allergies is the mistaken practice of prolonged food avoidance. The TINA study, conducted by Trendelenburg et al. (2022), showed that continued exclusion of foods after mild reactions can maintain or even worsen the allergy. On the contrary, supervised reintroduction, carried out with safety, proved to be effective in inducing tolerance, pointing to the need to review clinical conduct in cases of food hypersensitization (TRENDELENBURG et al., 2022).

Another relevant advance lies in the diagnostic accuracy of food allergies, which allows for personalized food introduction strategies. The use of technologies such as epitope mapping, described by Suárez-Fariñas et al. (2021), and the dosage of specific antibody subclasses, such as IgG4 and IgA (SMEEKENS et al., 2022), have been crucial in predicting each individual's immune response to food introduction. This paves the way for safer and more personalized approaches based on immunological biomarkers (SUÁREZ-FARIÑAS et al., 2021; SMEEKENS et al., 2022).

For children who cannot be fed exclusively with breast milk or who need specific formulas, the scenario is equally challenging. Studies such as GRITO (Lemoine et al., 2024) and the work by Dupont et al. (2015) have evaluated hydrolyzed formulas and their implications for tolerance induction. The results indicate that these formulas, when well indicated, are safe and effective and do not compromise the child's immune development. This expands the therapeutic and preventive possibilities even in more complex clinical situations (LEMOINE et al., 2024; DUPONT et al., 2015).

The effectiveness of the new guidelines also depends on adherence on the part of caregivers. Educational programs such as the one developed by Kwen and Oh (2022), aimed at parents of children with allergies, have shown a positive impact on both the understanding and execution of safe food introduction protocols. Health education therefore emerges as an essential tool in the interface between science and everyday practice, ensuring that the knowledge produced in academia is translated into real improvements in children's health (KWEN; OH, 2022).

Finally, the link between science, clinical practice and public policies is essential for the effective implementation of these strategies. The prevention of food allergies, based on early and personalized food introduction, requires a multidisciplinary approach that includes everything from professional training to the production of educational materials, including the funding of research programs and technological innovation. The future of pediatric dietary guidelines will inevitably depend on this, of this coordinated and continuous integration (LOGAN et al., 2023; DU TOIT et al., 2018; KALB et al., 2024).

The aim of this study was to carry out a critical analysis of recent scientific literature on the introduction of food in infancy and its relationship with the development or prevention of food allergies. It sought to understand how the new clinical guidelines, based on evidence from controlled studies and advances in immunology and microbiology, have reformulated the traditional approach, promoting the early introduction of allergenic foods as a preventive measure. In addition, the work addressed the impact of intestinal health, caregiver education and therapeutic strategies, such as oral immunotherapy, on the management of allergies, with the aim of offering a comprehensive, safe and well-founded view of the feeding process in early childhood.

METHODS

The search for scientific articles was carried out using the National Library of Medicine (PubMed) database. The descriptors were "*food allergies; child; development",* using the Boolean operator "AND" between the respective words. The categories were: clinical trial and randomized clinical trial. The studies were selected from publications between 2015 and 2025, using articles in English and Portuguese as inclusion criteria. Exclusion criteria were articles that added other pathologies to the central theme, disconnected from the proposed subject. The academic papers were reviewed using the following steps, in the following order: defining the topic; establishing the study categories; proposing inclusion and exclusion criteria; checking and then analyzing the publications; organizing the information; and presenting the data.

RESULTS

By combining the descriptors used, a total of 27,119 papers were obtained from the PubMed database. Using the inclusion criterion: articles published in the last 11 years (2015-2025), resulted in a total of 8864 articles. Next, articles of the type clinical trial, clinical trial and clinical trial were added as inclusion criteria randomized controlled trial or journal articles, for a total of 533 articles. Articles in Portuguese or English were selected, resulting in 509 articles and then the free full text option was added, totaling 225 articles. After reading the abstracts, those that did not fit the topic or were duplicated were excluded, totaling 32 articles, as shown in Figure 1.

DISCUSSION

Food introduction has been consolidated as a crucial moment in children's immune development, with direct implications for the prevention of food allergies. Contemporary literature has revisited old paradigms that suggested delaying the offer of potentially allergenic foods, replacing them with early exposure strategies as a preventive measure. At the heart of this debate, the studies by Logan et al. (2023) and Kalb et al. (2024) argue that early introduction, especially of peanuts, can significantly reduce the risk of allergy, even in high-risk populations. These investigations highlight the importance of dietary planning based on immunological evidence, challenging the traditional practice of prolonged food exclusion (LOGAN et al., 2023; KALB et al., 2024).

The immune window theory, supported by Perkin et al. (2019) in the EAT study, argues that there is a period of immune sensitivity in the first months of life in which contact with oral allergens can induce tolerance rather than sensitization. This hypothesis is corroborated by studies such as du Toit et al. (2018), whose clinical trial LEAP showed that children ex-
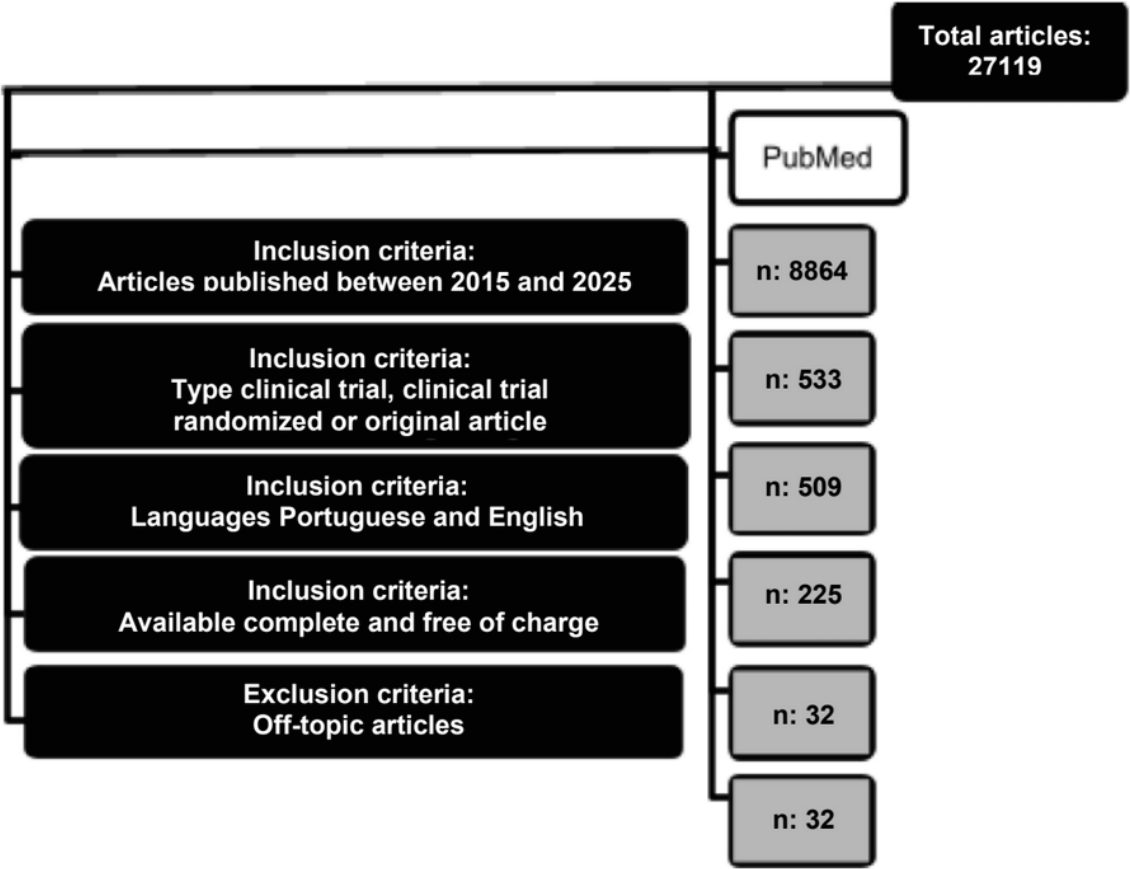
FIGURE 1: Flowchart for identifying articles in PubMed.
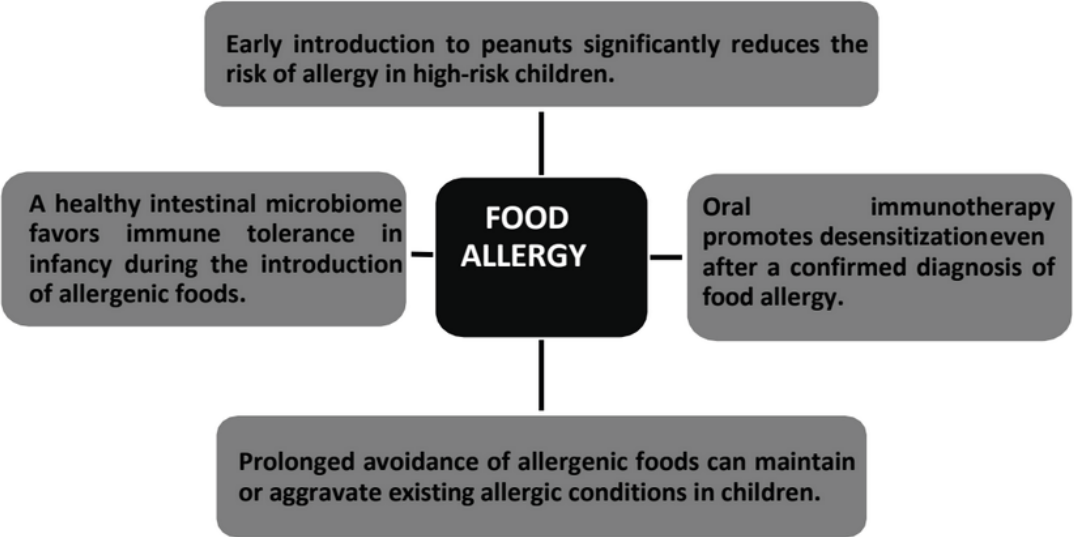
Source: Authors (2025)

FIGURE 2: Summary of the most frequently found results according to the articles analyzed.

Source: Authors (2025)

posed early to peanuts developed significantly fewer allergies compared to those not exposed. The convergence of findings from these studies points to a reformulation of pediatric guidelines on food introduction, emphasizing the early initiation of allergenic foods as a protective measure (PERKIN et al., 2019; DU TOIT et al., 2018).

The effects of early food introduction are not only limited to the reduction of specific allergies such as peanut, but also to the role of other foods and environmental factors. Kalb et al. (2024) in the TIFFANI project, and Bilaver et al. (2024) with iREACH, focused on the systematized introduction of multiple allergens. Such approaches broaden the scope of prevention beyond a single food, suggesting that immune training can be generalized. This logic underpins the concept of a diverse menu from the first months of life as a promoter of tolerance (KALB et al., 2024; BILAVER et al., 2024).

Although the early introduction of food has been shown to be effective, the role of the gut microbiome has emerged as a modulating factor in the success of this strategy. De Filippis et al. (2021) and Bao et al. (2021) demonstrated that the composition of the gut microbiota is closely linked to the development of immune tolerance. The presence of specific bacterial strains and an anti-inflammatory metabolic profile were associated with a lower incidence of allergies, which suggests that manipulating the microbiome, through diets or probiotics, can enhance the effects of early food introduction (DE FILIPPIS et al., 2021; BAO et al., 2021).

Complementing this line of reasoning, the OFFSPRING study (Shipton et al., 2024) investigated the impact of maternal supplementation with probiotics during pregnancy and lactation on the allergic susceptibility of offspring. The results suggest a synergistic relationship between microbial exposure and early food introduction, strengthening the hypothesis that dietary and environmental factors must be addressed together for effective prevention of food allergies (SHIPTON et al., 2024).

Advances in desensitization therapies, such as oral immunotherapy (OIT), have also contributed significantly to the understanding of food tolerance. Studies such as Jones et al. (2022) in the IMPACT trial and Kaushik et al. (2022) have shown that gradual exposure to increasing amounts of allergens can lead to sustained clinical desensitization. These approaches are close to the logic of early food introduction, but differ in that they are applied in contexts after diagnosis of established allergy, rather than preventatively (JONES et al., 2022; KAUSHIK et al., 2022).

On the other hand, the TINA study (Trendelenburg et al., 2022) takes a critical look at the practice of prolonged food avoidance, often adopted after episodes of mild allergic reactions. The research points out that this avoidance can paradoxically lead to the maintenance or worsening of the allergy, while the supervised and gradual reintroduction of allergenic foods has the potential to induce tolerance. This perspective reinforces the importance of clinical guidelines to guide parents and professionals regarding post-diagnosis management (TRENDELENBURG et al., 2022).

Meanwhile, the development of increasingly accurate diagnostic tools, such as the epitope mapping studied by Suárez-Fariñas et al. (2021), has made it possible to identify patients at greater risk of allergies early and safely. Associated with immunological data on specific antibodies such as IgE, IgG4 and IgA (SMEEKENS et al., 2022), these techniques improve the personalization of food introduction, adapting it to the immunological profile of each child (SUÁREZ-FARIÑAS et al., 2021; SMEEKENS et al., 2022).

Another relevant point is the introduction of food in special contexts, such as in children who need specific infant formulas. Studies such as GRITO (Lemoine et al., 2024) and Dupont et al. (2015) investigated the safety and efficacy of hydrolyzed protein formulas, showing that even in populations at higher risk, tolerance can be induced as long as food introduction occurs safely, respecting immunological individuality and adequate clinical support (LEMOINE et al., 2024; DUPONT et al., 2015).

Finally, the role of caregivers and educational policies in allergy management cannot be underestimated. Kwen and Oh (2022) showed that educational programs for parents of allergic children have a positive impact on adherence to recommendations and on reducing anxiety about food introduction. Health education must therefore go hand in hand with changes in clinical guidelines, ensuring that evidence--based practices are understood and applied by the general population (KWEN; OH, 2022).

In summary, current literature shows a growing convergence around the idea that early, diversified food introduction adapted to the child's immune profile can significantly reduce the risk of food allergies. Associated with a healthy microbiome, educational support for parents and adequate clinical follow-up, this strategy offers a promising new preventive approach. Replacing prolonged food exclusion with controlled exposure policies could represent a paradigm shift in the management of children's food health, with the potential to have a global impact on reducing the prevalence of allergies (LOGAN et al., 2023; DU TOIT et al., 2018; KALB et al., 2024).

CONCLUSION

From this critical and integrative analysis of recent scientific literature, it was possible to see that early food introduction represents one of the most promising approaches to preventing food allergies in childhood. The change in clinical guidelines is supported by solid evidence indicating that controlled and early exposure to allergenic foods, such as peanuts and eggs, promotes the induction of immunological tolerance and significantly reduces the incidence of adverse reactions in the long term. The effectiveness of this strategy is amplified when associated with a balanced intestinal microbiome, which demonstrates the importance of intestinal health as an essential component of immunity. Another central point of the discussion was the role of oral immunotherapy in the management of established allergies. Although it is a therapeutic rather than preventative strategy, the immunological mechanisms underlying desensitization show parallels with the tolerance processes induced by food introduction. Recent studies have revealed that children submitted to this treatment modality can develop sustained immune responses, which reinforces the relevance of gradual and supervised food exposure as an immune modulation tool. The risk associated with prolonged avoidance of allergenic foods has also been highlighted. Contrary to what was previously advocated, the exclusion of suspect foods for long periods can maintain sensitization or even aggravate it. The literature reviewed showed that gradual and safe reintroduction can be more beneficial for the development of tolerance than total avoidance, even in children who are already sensitized. Finally, educating caregivers and personalizing dietary management, based on immunological biomarkers and early diagnosis, have proven to be fundamental to the success of preventive strategies. It is essential that public policies, clinical guidelines and health actions are aligned with the new scientific reality, promoting food care that is based on evidence, accessible and centered on the integral health of the child.

REFERENCES

KALB B et al. **Tolerance induction through early feeding to prevent food allergy in infants and children with sensitization against food allergens (TIFFANI): rationale, study design, and methods of a randomized controlled trial** Trials, 2024; 25(1):272.

BILAVER LA et al. **Design of the Intervention to Reduce Early Peanut Allergy in Children (iREACH): A practice-based clinical trial** Pediatr Allergy Immunol, 2024; 35(4):e14115.

SHIPTON EV et al. **OFFSPRING: A SPRING Follow-Up Study Assessing the Efficacy of Maternal Probiotics and Allergic Disease in the Child** Int Arch Allergy Immunol, 2024; 185(3):212-217.

DALLACKER M et al. **Effect of Longer Family Meals on Children's Fruit and Vegetable Intake: A Randomized Clinical Trial** JAMA Netw Open, 2023; 6(4):e236331.

GRINEK S et al. **Epitope-Specific IgE at 1 Year of Age Can Predict Peanut Allergy Status at 5 Years** Int Arch Allergy Immunol, 2023; 184(3):273-278.

LOGAN K et al. **Early introduction of peanut reduces peanut allergy across risk groups in pooled and causal inference analyses** Allergy, 2023; 78(5):1307-1318.

LEMOINE A et al. **Growth, Safety and Tolerance in Infants Fed Rice Protein Hydrolysate Formula: The GRITO Randomised Controlled Trial** Nutrients, 2024; 17(1):162.

KWEN H et al. **Development and Evaluation of a Mobile Web-based Food Allergy and Anaphylaxis Management Educational Program for Parents of School-aged Children with Food Allergy: A Randomized Controlled Trial** Asian Nurs Res, 2022; 16(5):265-274.

KAUSHIK A et al. **CD8+ T cell differentiation status correlates with the feasibility of sustained unresponsiveness following oral immunotherapy** Nat Commun, 2022; 13(1):6646.

SMEEKENS JM et al. **Peanut-Specific IgG4 and IgA in Saliva Are Modulated by Peanut Oral Immunotherapy** J Allergy Clin Immunol Pract, 2022; 10(12):3270-3275.

KULIS MD et al. **Kinetics of basophil hyporesponsiveness during short-course peanut oral immunotherapy** J Allergy Clin Immunol, 2022; 150(5):1144-1153.

TRENDELENBURG V et al. Tolerance induction through non-avoidance to prevent persistent food allergy (TINA) in children and adults with peanut or tree nut allergy: rationale, study design and methods of a randomized controlled trial and observational cohort study Trials, 2022; 23(1):236.

JONES SM et al. **Efficacy and safety of oral immunotherapy in children aged 1-3 years with peanut allergy (the Immune Tolerance Network IMPACT trial): a randomised placebo-controlled study** Lancet, 2022; 399(10322):359-371.

DE FILIPPIS F et al. **Specific gut microbiome signatures and the associated pro- inflamatory functions are linked to pediatric allergy and acquisition of immune tolerance** Nat Commun, 2021; 12(1):5958.

ANVARI S et al. **Memory and naïve gamma delta regulatory T-cell gene expression in the first 24-weeks of peanut oral immunotherapy** Clin Immunol, 2021; 230:108820.

FERNANDEZ-RIVAS M et al. **Open-label follow-on study evaluating the efficacy, safety, and quality of life with extended daily oral immunotherapy in children with peanut allergy** Allergy, 2022; 77(3):991-1003.

SUÁREZ-FARIÑAS M et al. **Accurate and reproducible diagnosis of peanut allergy using epitope mapping** Allergy, 2021; 76(12):3789-3797.

BAO R et al. **Fecal microbiome and metabolome differ in healthy and food-allergic twins** J Clin Invest, 2021; 131(2):e141935.

MAEDA M et al. **Effect of oral immunotherapy in children with milk allergy: The ORIMA study** Allergol Int, 2021; 70(2):223-228.

BURRELL S etal. **Self-administration of adrenaline for anaphylaxis during in-hospital food challenges improves health-related quality of life** Arch Dis Child, 2021; 106(6):558- 563.

PERKIN MR et al. **Efficacy of the Enquiring About Tolerance (EAT) study among infants at high risk of developing food allergy** J Allergy Clin Immunol, 2019; 144(6):1606-1614.e2.

REMINGTON BC et al. **Estimated risk reduction to packaged food reactions by epicutaneous immunotherapy (EPIT) for peanut allergy** Ann Allergy Asthma Immunol, 2019; 123(5):488-493.e2.

SUÁREZ-FARIÑAS M et al. **Predicting development of sustained unresponsiveness to milk oral immunotherapy using epitope-specific antibody binding profiles** J Allergy Clin Immunol, 2019; 143(3):1038-1046.

CHINTHRAJAH RS et al. **Development of a tool predicting severity of allergic reaction during peanut challenge** Ann Allergy Asthma Immunol, 2018; 121(1):69-76.e2.

ANDO T et al. **Histamine-releasing factor enhances food allergy** J Clin Invest, 2017; 127(12):4541-4553.

DU TOIT G et al. **Allergen specificity of early peanut consumption and effect on development of allergic disease in the Learning Early About Peanut Allergy study cohort** J Allergy Clin Immunol, 2018; 141(4):1343-1353.

BIRD JA et al. **Efficacy and Safety of AR101 in Oral Immunotherapy for Peanut Allergy: Results of ARC001, a Randomized, Double-Blind, Placebo-Controlled Phase 2 Clinical Trial** J Allergy Clin Immunol Pract, 2018; 6(2):476-485.e3.

JONES SM et al. **Epicutaneous immunotherapy for the treatment of peanut allergy in children and young adults** J Allergy Clin Immunol, 2017; 139(4):1242-1252.e9.

SCALABRIN D et al. **Long-term safety assessment in children who received hydrolyzed protein formulas with Lactobacillus rhamnosus GG: a 5-year follow-up** Eur J Pediatr, 2017; 176(2):217-224.

METCALFE JR et al. **Effects of maternal dietary egg intake during early lactation on human milk ovalbumin concentration: a randomized controlled trial** Clin Exp Allergy, 2016; 46(12):1605-1613.

DZIDIC M et al. **Aberrant IgA responses to the gut microbiota during infancy precede asthma and allergy development** J Allergy Clin Immunol, 2017; 139(3):1017-1025.e14.

DUPONT C et al. **An extensively hydrolysed casein-based formula for infants with cows' milk protein allergy: tolerance/hypo-allergenicity and growth catch-up** Br J Nutr, 2015; 113(7):1102-12.