



Early Solid Food Introduction: Role in Food Allergy Prevention and Implications for Breastfeeding

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Food allergy is estimated to affect 2%-10% of the population worldwide.¹ The US Centers for Disease Control and Prevention reported an increase in food allergy prevalence in the US from 3.4% to 5.1% between 1997 and 2011.² As a result, the focus in food allergy research has shifted from treatment to prevention.²

Some studies have suggested that early introduction of allergenic solids, before age 6 months, may be an effective means of prevention, particularly for egg and peanut allergy.³ However, earlier introduction of solid food risks directly contradicting current World Health Organization (WHO) recommendations, as well as many general pediatric guidelines, specifying exclusive breastfeeding until age 6 months.⁴⁻⁶ The WHO recommendations were not meant for allergy prevention and were developed before recent research that has solidified a relationship between food allergy prevention and early solid food introduction. However, the potential implications of earlier solid food introduction on the benefits of exclusive breastfeeding, as well as total breastfeeding duration, must be evaluated as well. Here we explore the evidence suggesting that introduction of solid foods before age 6 months might reduce the risk of food allergy. In addition, we review the possible implications of earlier solid food introduction on both the benefits of exclusive breastfeeding and the total duration of breastfeeding.

The Role of Solid Food Introduction Before Age 6 Months in Food Allergy Prevention

Several key observational studies published over the last decade have suggested that the introduction of potentially allergenic solid foods before age 6 months may be associated with a decreased risk of developing food allergy (see the **Table** for a summary of key studies). In 2008, a questionnaire-based survey found a 10-fold higher prevalence of peanut allergy among Jewish schoolchildren in the United Kingdom compared with Jewish schoolchildren in Israel (1.85% vs 0.17%; $P < .001$).⁷ This difference in prevalence was attributed to earlier and more frequent peanut exposure in the first year of life in Israel

compared with the United Kingdom. In 2010, an Australian population-based cross-sectional study of 2589 infants found that introduction of egg at age 4-6 months was associated with a lower prevalence of egg allergy compared with later introduction (aOR, 1.6 for introduction at 10-12 months and 3.4 for introduction after 12 months).⁸ In the same year, a prospective study of the feeding history of more than 13 000 Israeli infants found that regular exposure to cow's milk formula starting within the first 14 days of life was associated with a lower risk of cow's milk allergy compared with later exposure (OR, 19.3 for introduction after 14 days).⁹ In addition, a case-control study noted that delaying cow's milk introduction for more than 1 month after birth, or feeding it irregularly, was associated with a higher rate of cow's milk allergy (aOR, 23.7 compared with control and 10.2 compared with the egg allergy group).¹⁰

Several recently published observational studies also have suggested that increased food diversity early in life can decrease the risk of allergic diseases, including food allergy. In 2011, a longitudinal birth cohort of 594 infant-mother pairs in the US noted that complementary food introduction before age 4 months reduced the risk of peanut sensitization (aOR, 0.2; $P = .007$), and perhaps egg sensitization as well (if egg-specific IgE ≥ 0.70 kU/L was used as a cutoff; OR, 0.5; $P = .022$) at age 2 years in children with parents with allergies or asthma.¹¹

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AAP	American Academy of Pediatrics
CPS	Canadian Paediatric Society
EAT	Enquiring About Tolerance
LEAP	Learning Early About Peanut
NNT	Number needed to treat
SPT	Skin prick test
WHO	World Health Organization

Table. Key food allergy prevention studies in the 4- to 6-month interval

Authors and countries	Year	Number of participants	Study design	Outcome studied	Key findings
Observational studies					
Du Toit et al ⁷ , United Kingdom and Israel	2008	5171 Jewish schoolchildren in the United Kingdom and 5615 Jewish schoolchildren in Israel	Clinically validated questionnaire to determine peanut allergy prevalence and its relationship to peanut consumption during infancy	Peanut allergy (identified on questionnaire; followed by peanut-specific IgE or SPT or oral challenge)	Higher incidence of peanut allergy in United Kingdom children compared with Israeli children (1.85% vs 0.17%; $P < .001$). Peanut introduced earlier and eaten more frequently in Israel than in the United Kingdom.
Johnson et al ¹¹ , US	2011	594 infant–mother pairs from the general population	Longitudinal birth cohort investigating relationship between early food introduction and food sensitization	Food sensitization (specific IgE to egg, milk, peanut) at age 2-3 y	Decreased peanut sensitization with complementary food introduction before age 4 mo (aOR, 0.2); decreased egg sensitization if egg-specific IgE ≥ 0.70 kU/L used as cutoff (OR, 0.5) in children with parental atopy
Katz et al ⁹ , Israel	2010	13 019 infants from the general population	Prospective birth cohort to determine risk factors for cow's milk allergy development	Cow's milk allergy (cow's milk SPT and oral challenge)	Decreased incidence of cow's milk allergy with cow's milk introduction in first 14 d of life (OR, 19.3 for introduction >14 d)
Koplin et al ⁸ , Australia	2010	2589 infants from the general population	Population-based cross-sectional study investigating relationship between egg allergy and age of solid introduction	Egg allergy (egg SPT or oral challenge)	Decreased egg allergy with egg introduction at age 4-6 mo (aOR, 1.6 at for introduction at age 10-12 mo)
Nwaru et al ¹² , Finland	2010	994 infants from the general population with HLA- conferred susceptibility to type I diabetes	Prospective birth cohort examining relationship between age of introduction of solid foods and allergen-specific IE levels at age 5 y	Food allergen sensitization (defined by allergen-specific IgE levels) at age 5 y	Increased food allergen sensitization with delayed introduction of multiple foods including potatoes (>4 mo), oats (>5 mo), wheat (>6 mo), and meat (>5.5 mo)
Onizawa et al ¹⁰ , Japan	2016	51 infants with IgE-mediated cow's milk allergy	Retrospective case-control study comparing infants with cow's milk allergy with 102 matched controls and 32 matched infants with egg allergy	Variables associated with cow's milk allergy development	Increased cow's milk allergy with delayed (>1 mo after birth) or infrequent ($<1/d$) cow's milk exposure (aOR, 23.7 compared with control; 10.1 compared with egg allergy group)
Clinical trials					
Bellach et al ²⁰ , Germany	2016	406 infants from the general population (screened by egg- specific IgE first; included those who were negative)	Randomized controlled trial of pasteurized raw egg powder introduction 3 times/wk at 4-6 mo vs placebo until age 1 y	Egg allergy (egg-specific IgE and oral challenge) at age 12 mo	No difference in rate of egg allergy (2.1% vs 0.6%; $P = .35$) or egg sensitization (5.6% vs 2.6% $P = .24$); high reaction rate ($\sim 5\%$) with early introduction
Du Toit et al ¹³ , United Kingdom	2015	640 infants age 4-11 mo with eczema or egg allergy	Randomized controlled trial of early peanut introduction (6 g of peanut protein distributed into 3 or more meals per week) at age 4-11 mo or avoidance until age 5 y	Peanut allergy (oral food challenge) at age 5 y	Decreased peanut allergy with peanut introduction at age 4-11 mo compared with 5 y (3.2% vs 17.2%; adjusted relative risk, 14; NNT, 7.1)
Natsume et al ¹⁶ , Japan	2016	121 infants with eczema	Randomized controlled trial of heated egg powder daily from age 6 mo vs avoidance until age 12 mo	Egg allergy at age 12 mo	Decreased egg allergy with early introduction (8.3% vs 37.7%; $P = .0013$)
Palmer et al ¹⁸ , Australia	2013	86 infants with moderate to severe eczema	Randomized controlled trial of daily pasteurized raw egg powder introduction at age 4 mo vs avoidance until age 8 mo	Egg allergy at age 1 y (egg SPT and pasteurized raw egg challenge)	Nonsignificant decrease in egg allergy with introduction at 4 mo (33% vs 51%; $P = .11$), but increased egg-specific IgG4 ($P < .001$); high rate of reactions with early introduction (31% of 4-mo group)
Palmer et al ¹⁹ , Australia	2016	820 infants with a family history of atopy	Randomized controlled trial of daily pasteurized raw egg powder introduction at age 4-6.5 mo vs avoidance until age 10 mo	Egg allergy at age 1 y (egg SPT and pasteurized raw egg challenge)	Nonsignificant decrease in egg allergy with introduction at 4-6.5 mo (7.0% vs 10.3%; $P = .20$), but increased egg-specific IgE in 4-6.5 mo group vs 10 mo group ($P < .0001$)
Perkin et al ^{15,28} , United Kingdom	2016	1303 exclusively breastfed infants from the general population	Randomized controlled trial to early (3 mo) or standard (6 mo) introduction of 6 allergenic foods (cows milk, egg, wheat, fish, peanut, sesame)	Food allergy to 1 of 6 intervention allergens at age 1-3 y (oral food challenge)	Nonsignificant difference in rate of food allergy in intention-to-treat analysis; decreased rates of peanut allergy (0% vs 2.5%; NNT, 40) and egg allergy (1.4% vs 5.5%; NNT, 26) in per protocol analysis
Tan et al ¹⁷ , Australia	2016	319 infants with a family history of atopy and SPT <2 mm to egg	Randomized controlled trial of daily pasteurized whole egg powder at age 4 mo vs placebo (egg introduction at age 8 mo)	Egg allergy at age 1 y (egg SPT and egg oral challenge)	Decreased rate of egg sensitization (20% vs 11%; OR, 0.46); nonsignificant trend toward reduced egg allergy with introduction at age 4 mo vs 8 mo.
Ongoing studies					
PreventADALL (ongoing), Norway		2500 infants from the general population	Open label randomization to either, both, or neither of 2 interventions: introduction of allergenic foods (egg, milk, wheat, peanut) by age 4 mo and regular emollient use	Presence of atopic dermatitis and food allergy to 1 of the 4 intervention allergens	Ongoing
PEAAD (ongoing), Germany		Children with eczema aged 5-30 mo	Primary care provider chooses regular peanut consumption or avoidance for 1 y	Peanut allergy 1 y after enrollment	Ongoing

HLA, human leukocyte antigen; IgE, Immunoglobulin E.

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