

Introduction of Complementary Foods and the Relationship to Food Allergy

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KEY WORDS

breastfeeding, food allergy, infant feeding, prevention

ABBREVIATIONS

DBPCFC—double-blind, placebo-controlled food challenge

PIFA—Prevalence of Infant Food Allergy Study

WHO—World Health Organization

Dr Grimshaw was involved in writing the original study protocol, data collection, diagnosis of food allergy, statistical analysis and data management, and initial drafting and revision of the manuscript; Mr Maskell was involved in statistical analysis and data management, and revision of the manuscript for important intellectual content; Ms Oliver and Ms Morris were involved in data collection, diagnosis of food allergy, and revision of the manuscript for important intellectual content; Dr Foote was involved in the initiation and set up of the study, data collection, diagnosis of food allergy, and revision of the manuscript for important intellectual content; Prof Mills was involved in the conception and design of the original study protocol and revision of the manuscript for important intellectual content; Prof Roberts was involved in the initiation and set-up of the study, data collection, diagnosis of food allergy, statistical analysis and interpretation of the data, and revision of the manuscript for important intellectual content; and Prof Margetts was involved in the initiation and set-up of the study, statistical analysis and interpretation of the data, and revision of the manuscript for important intellectual content. All authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Breast milk is protective against many conditions, but its role in allergy has not been established. Infant-feeding recommendations support exclusive breastfeeding for 26 weeks, whereas allergy prevention recommendations advise exclusive breastfeeding for 4 to 6 months with continued breastfeeding thereafter.



WHAT THIS STUDY ADDS: Evidence that continued breastfeeding while solids are introduced into the diet and delaying the introduction of solids until at least 17 weeks of age are associated with fewer food allergies.

abstract

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OBJECTIVES: To address questions regarding breastfeeding, complementary feeding, allergy development, and current infant-feeding recommendations.

METHODS: This was a nested, case-control within a cohort study in which mothers of 41 infants diagnosed with food allergy by the age of 2 years (according to double-blind, placebo-controlled food challenge) and their 82 age-matched controls kept prospective food diaries of how their infants were fed in the first year of life.

RESULTS: Infants who were diagnosed with food allergy by the time they were 2 years of age were introduced to solids earlier (≤ 16 weeks of age) and were less likely to be receiving breast milk when cow's milk protein was first introduced into their diet.

CONCLUSIONS: This study supports the current American Academy of Pediatrics' allergy prevention recommendations and the European Society of Pediatric Gastroenterology, Hepatology and Nutrition recommendations on complementary feeding to not introduce solids before 4 to 6 months of age. It also supports the American Academy of Pediatrics' breastfeeding recommendations that breastfeeding should continue while solids are introduced into the diet and that breastfeeding should continue for 1 year, or longer, as mutually desired by mother and infant. *Pediatrics* 2013;132:e1529–e1538

Since announcement of the World Health Organization (WHO) recommendation that all infants be exclusively breastfed for 26 weeks, there has been an ongoing debate as to whether the recommendation is wholly appropriate for all infants from developed countries. The debate is well illustrated by a review by Fewtrell et al¹ and the letters of response published in 2011.^{2–4}

Although there is no doubt as to the nutritional and emotional benefits of breastfeeding, the crux of the argument is the benefit of exclusive breastfeeding to 26 weeks. One side (pro– exclusive breastfeeding to 26 weeks) believe breast milk to be nutritionally adequate to the age of 6 months, that exclusive breastfeeding is protective against a plethora of infant conditions,^{5–8} and that these benefits are demonstrated in developed as well as underdeveloped countries.⁹ This view is currently advocated by the American Academy of Pediatrics, the European Society of Pediatric Gastroenterology, Hepatology and Nutrition, and the UK Department of Health.^{10–12} The other side of the argument is that although exclusive breastfeeding for 26 weeks is undoubtedly the best recommendation for infants in underdeveloped countries, in developed countries, where the risk of gastrointestinal infections are reduced and allergic conditions are increased, the benefits of exclusive breastfeeding for this long are not as strong. Calls for further work in this area have been made, with the American Academy of Pediatrics recommending that solids be introduced between 4 and 6 months of age for allergy prevention.^{10,13} Failure to resolve the debate undermines the authority of current infant-feeding recommendations, which can cause confusion in health care workers and parents alike.

To inform the debate, we examined the relationship between breastfeeding, complementary feeding, and allergy development in a nested, case-control study within a cohort study in which mothers kept prospective food diaries of how their infants were fed in the first year of life. The study design facilitated the collection of accurate data on the initiation, duration, and exclusivity of breastfeeding, as well as the nature of introduction of solids.

METHODS

The PIFA (Prevalence of Infant Food Allergy) study is a prospective birth cohort of 1140 infants recruited between 2006 and 2008, and it was the UK cohort of the EuroPrevall project¹⁴ with study size and eligibility criteria determined by that study's protocol.¹⁵ It received approval from the research and development departments at the Royal Hampshire County Hospital, Winchester and Southampton General Hospital, and ethical approval was granted by the North and Mid Hampshire Local Research Ethics Committee and the Southampton and South West Hampshire Local Research Ethics Committee (05/Q1703/34).

Infants from the PIFA study who had been diagnosed as having a food allergy (according to a double-blind, placebo-controlled food challenge [DBPCFC]¹⁵) and their 2 age-matched controls were included in a “nested within a cohort, case-control study.” Controls comprised infants with birthdays closest to the index cases and whose parents consented. They were assessed by using the same symptomatic questionnaire and physical examination to ensure that they exhibited no signs of food allergy.

Study Design

The PIFA study has a longitudinal prospective cohort design starting from

birth. Interested women met 1 of the study research fellows; informed consent was recorded, and baseline information on socioeconomic, environmental, and family allergy history was collected. Women were also invited to keep food diaries for their infants from birth until 1 year of age. Mothers/caregivers returned the food diaries to the study office monthly. Mothers were also sent a new symptom sheet every 2 months to facilitate identification of symptomatic infants, with parents being asked to contact the study team if they thought their child developed signs of allergic disease. One of the parents was asked to complete the EuroPrevall telephone questionnaire when their infant reached the age of 12 months and again at 24 months. The symptomatic sheets and the 12- and 24-month questionnaires also served to identify infants who may have a food allergy. Prospective completion of food diaries and symptom sheets reduced the potential for experimental bias.

Food Allergy Diagnosis

Possible cases of food allergy were triaged via telephone, and those patients fulfilling the EuroPrevall-wide criteria for assessment were invited for a symptomatic visit, at which the EuroPrevall symptomatic questionnaire was completed, a physical examination was performed, skin prick testing was completed, and a blood sample was taken.¹⁵ Any infant with a convincing clinical history of food allergy, presence of serum-specific immunoglobulin E to a common food allergen (≥ 0.35 kU/L), and/or a positive skin prick test result (≥ 3 -mm wheal) was placed on an exclusion diet for the suspected food(s). If symptoms improved, the child attended the Southampton Wellcome Trust Clinical Research Facility for a DBPCFC. The diagnostic criterion for food allergy in this study for all infants was a positive

DBPCFC (which included delayed reactions up to 48 hours after the challenge).

Dietary Intake Data

At recruitment, parents were asked to record daily anything their child ate or drank for the first year of life on food diary sheets designed for the purpose, and they were instructed on their completion. Diary sets (which consisted of 4 weekly sheets) were sent out every 2 months, with parents being asked to return each diary to the study office once it was completed. Freepost envelopes were provided for their return.

To reduce the burden of food diary completion, parents were asked to record what the child consumed but not the amounts of food taken. Upon receipt, diaries were reviewed, and where they lacked adequate detail (eg, type of infant formula given), parents were contacted by telephone so these data could be recorded. The data from all diaries were analyzed in the same manner to determine the timing of specific events such as when infant formula or any solid/semi-solid food was first introduced into the diet and the age at which breastfeeding stopped. In the current article, “exclusive breastfeeding” is defined as when an infant receives only breast milk, water, or vitamin/mineral drops. “Introduction of solid foods” refers to when the infants first received solid/semi-solid foods.

Statistical Analysis

A descriptive analysis of baseline characteristics (obtained via standard questionnaire administered at recruitment¹⁵), any health and clinical symptoms (obtained by using a symptomatic questionnaire and physical examination), and dietary intake data (obtained via food diary analysis) for infants involved in the study was

conducted by using SPSS version 17 (IBM SPSS Statistics, IBM Corporation, Armonk, NY). Continuous variables were described in terms of means \pm standard deviations or medians and ranges depending on their distribution. Categorical variables were described in terms of numbers and percentages. Descriptive statistics, χ^2 tests, and Mann-Whitney *U* tests were used on all available dietary intake data. Kaplan-Meier survival analysis was used to establish additional details about breastfeeding duration. The study sample size had sufficient power to detect an odds ratio of ≥ 0.48 at 80% power and a significance level of .05. This equates to infants who went on to develop a food allergy receiving solids 2 weeks earlier than for the infants who did not develop a food allergy.

Finally, analysis by using a multivariable logistic model was conducted. This analysis included variables that the previous analyses had identified as being significantly different between the study groups and also factors which are considered to be associated with allergy development.

RESULTS

Participants

Infants were from the PIFA study ($N = 1140$) who had either been diagnosed as having a food allergy according to DBPCFC ($n = 41$) or were their age-matched controls ($n = 82$). Figure 1 shows infant numbers at each stage of the main PIFA study and also the stages of diagnosis of the food-allergic infants. The study infants ($N = 123$) were born between January 2006 and October 2007. Median maternal age was 33 years (range: 19–43 years), and median infant weight was 3420 g (range: 2160–5060 g). Baseline characteristics for the infants who became food allergic and their controls are detailed in Table 1. The demographic characteristics of the main PIFA study population ($N = 1140$) differed from those of the community from which it was recruited because it had a large proportion of older, well-educated mothers. However, the infants in the 2 experimental groups of the current study ($N = 123$) did not differ significantly from each other for any demographic or environmental

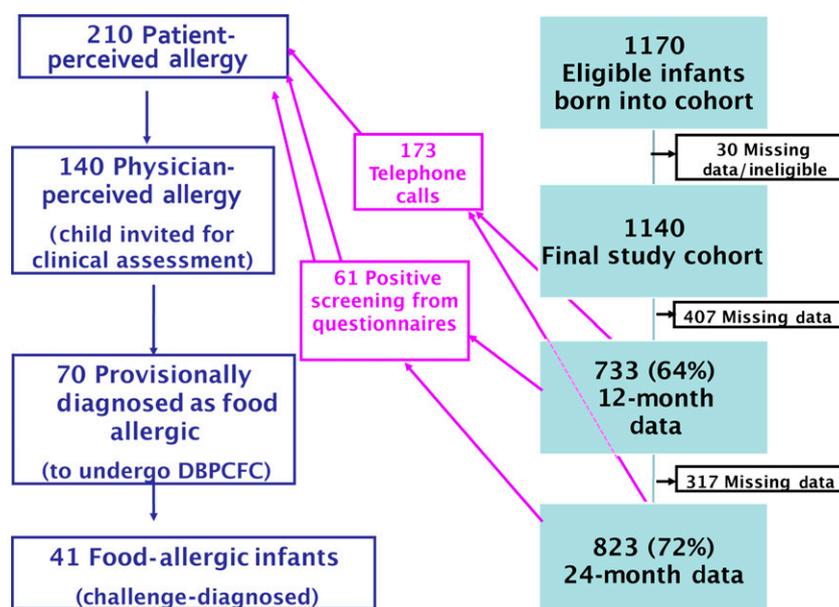


FIGURE 1
Flowchart of participants in the PIFA study.

measurement. Median age at start of symptoms of food allergy was 24 weeks (range: 0–64 weeks). Median age at DBPCFC was 56 weeks. The most common causative food was hen's egg (22 infants), closely followed by cow's milk (20 infants). Twelve infants were allergic to >1 food. Infants displayed differing symptoms, with some infants displaying >1 symptom. The most common symptom was physician-diagnosed eczema (12 infants), with vomiting being the second most common (11 infants). Details of the infant diet when symptoms started are given in Table 2. No infant who was allergic to egg experienced symptoms before consuming egg; however, 1 peanut-allergic infant experienced cutaneous symptoms after contact with the allergen before any peanut consumption.

Breastfeeding

Ninety-five percent of all mothers included in the study initiated breastfeeding, with a median duration of 20 weeks (range: 0–64 weeks). Median duration for exclusive breastfeeding was 8 weeks (range: 1–26 weeks), with

50% of mothers still exclusively breastfeeding at 9 weeks. There was no statistically significant difference between breastfeeding initiation, duration, or exclusive breastfeeding duration between the symptomatic and control infants (Table 3). Exclusivity was lost to whey-predominant infant formula in 78% of infants, with only 2 infants losing exclusivity due to a different type of formula (casein-predominant and extensively hydrolyzed formula). The second most common way for infants to lose their exclusive breastfeeding status was to have rice introduced into the diet (in the form of "baby rice").

Kaplan-Meier analysis indicated how the nature of breastfeeding differed between the 2 study groups (Fig 2). This difference was not significant (generalized Wilcoxon [Breslow] test, $P = .335$).

Concurrent Feeding With Cow's Milk Protein and Breast Milk

There was no statistically significant difference between groups for the age cow's milk (in any form) was introduced into the diet (Table 4). However, among

TABLE 2 Details of Infant Diet at Time When Symptoms Started

Infants Diet at Start of Symptoms	No. of Infants
Infant formula and solids	15
Infant formula	9
Infant formula and breast milk	5
Breast milk	5
Breast milk, infant formula, and solids	4
Breast milk and solids	3

infants who received both cow's milk in any form and breast milk ($n = 27$, allergy group; $n = 72$, control group), the duration of concurrent feeding was 5.5 weeks in the allergy group versus 9 weeks in the control group ($P = .047$). To investigate whether the duration of overlap was important, the variables were recoded to provide a categorical "concurrent breastfeeding" variable. Again, there was a statistically significant difference between the groups for concurrent feeding with cow's milk in any form and breast milk ($P = .015$), suggesting that any concurrent feeding is beneficial. Because the timing of the overlap may be important, a post hoc analysis was conducted to compare whether the ages when concurrent breastfeeding occurred differed between the 2 groups, and no significant difference was found (Mann-Whitney U test, $P = .300$).

There were insufficient numbers of infants commencing foods other than cow's milk while being breastfed to explore whether this factor affected the development of food allergy.

Introduction of Solid Foods

The mean age of any solid introduction was 20.3 weeks. The food with the earliest median age of introduction was rice at 20 weeks (given predominantly as "baby rice"), with carrots introduced at a median age of 21 weeks and apples and bananas at a median age of 22 weeks. The food that was most commonly introduced before 17 weeks of age was rice (20 infants). The other common foods introduced before 17

TABLE 1 Characteristics of the Mother and Infant Pairs Included in This Prospective Case-Control Study

Characteristic	Food Allergy ($n = 41$)	Control ($n = 82$)	P^a
Male gender	24 (58.5)	43 (52.4)	.522
Median birth weight, g	3480.0 (2160–4120)	3370.0 (2270–5060)	.913 ^b
Median length, cm	53.0 (48–59)	52.0 (47–61)	.909 ^b
Duration of pregnancy, wk	39.5 (36–42)	40.0 (36–42)	.062 ^b
Median maternal age, y	31.0 (19–43)	33.0 (22–42)	.192 ^b
Median paternal age, y	33.5 (21–42)	34.0 (23–49)	.247 ^b
Maternal education			
Did not complete basic education	0 (0)	0 (0)	.448
Completed basic education	4 (9.7)	6 (7.3)	
Junior college/vocational training	11 (26.8)	15 (18.3)	
University/college	26 (63.4)	61 (74.4)	
Median maternal prepregnancy BMI, kg/m ²	22.9 (16.6–43.0)	22.8 (16.5–49.2)	.323 ^b
Maternal asthma	11 (26.8)	11 (13.4)	.067
Maternal allergy	22 (53.7)	31 (37.8)	.105
Maternal smoking	1 (2.4)	3 (3.7)	1.000
Only child	24 (58.5)	49 (59.8)	.570
Urban dwelling	8 (19.5)	11 (13.4)	.378
Pet ownership	26 (63.4)	40 (48.8)	.142

Data are presented as n (%) or median (range).

^a χ^2 test.

^b Mann-Whitney U test.

TABLE 3 Breastfeeding Characteristics for Infants With Food Allergy and Control Infants in the Study

Characteristic	Food Allergy (<i>n</i> = 41)	Control (<i>n</i> = 82)	<i>P</i>
No. (%) initiating breastfeeding	38 (92.7)	79 (96.3)	.210 ^a
Breastfeeding duration, wk			
Median	21.0	24.0	.295 ^b
Interquartile range	3.0–30.5	7.0–31.0	
Range	0–64	0–52	
Exclusive breastfeeding duration, wk			
Median	5.0	8.5	.933 ^b
Interquartile range	2.8–16.3	4.0–15.0	
Range	1–26	1–24	

^a χ^2 test.^b Mann-Whitney *U* test.

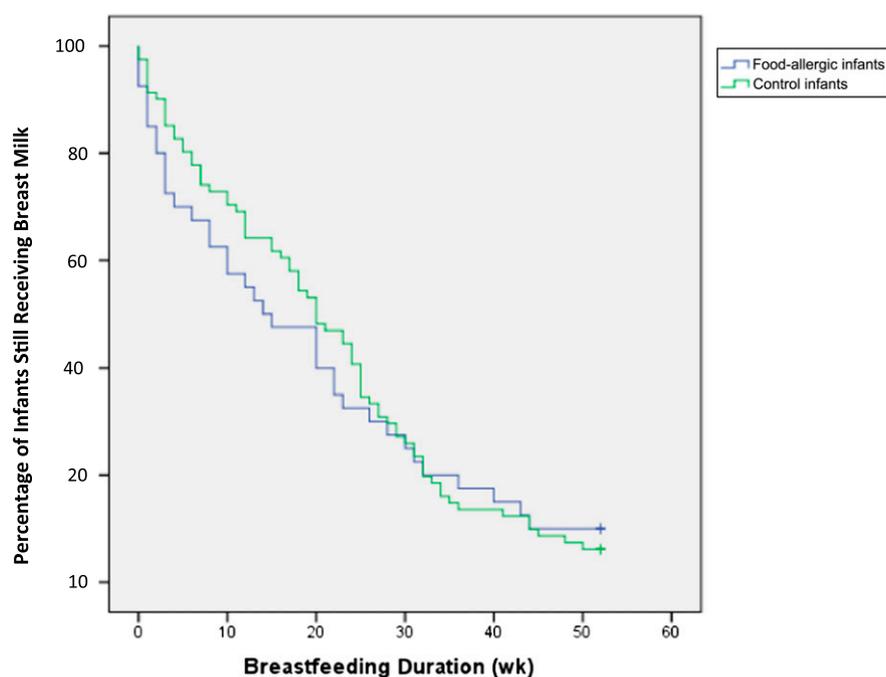
weeks of age were apples, bananas, and pears (11, 8, and 8 infants, respectively). The first cow's milk protein taken as an ingredient was most likely to be from yogurt/fromage frais. Solids were introduced significantly earlier in food-allergic infants compared with control infants ($P = .044$), as was cow's milk as an ingredient ($P = .049$) and peanut ($P = .037$) (Table 4). Control infants were introduced to solids first, but between 12 and 16 weeks, 15% of food-allergic infants were introduced to solids compared with only 9% of control infants (Fig 3). A post hoc analysis was

undertaken that stratified the timing of complementary food introduction into 2 groups: introduction before and including 16 weeks of age and introduction at ≥ 17 weeks of age. Significantly more food-allergic infants were introduced to complementary foods at ≤ 16 weeks than control infants (35% vs 14%; $P = .011$).

Multivariable Logistic Model

The model included age at solid introduction, concurrent breastfeeding, and cow's milk in any form, which were variables that the previous analyses

had identified as being significantly different between the study groups. Age at solid introduction was changed to a categorical variable because the result of the post hoc analysis found that solid introduction before 17 weeks of age was strongly associated with food allergy development. The concurrent breastfeeding and cow's milk variable was also recoded into a categorical variable because earlier analysis showed any concurrent breastfeeding seemed to be beneficial. Cow's milk as an ingredient was not included in the model due to multicollinearity, and age at first peanut consumption was not included due to reverse causation. Factors considered to be associated with allergy development (maternal asthma, allergy, education, age, pet ownership, infant gender, and single birth) were also included in this model. Maternal smoking was not included in the model because the proportion of smoking mothers was rare for all infants (3.3%) and was not significantly different between the groups.

**FIGURE 2**

Kaplan-Meier survival analysis plot showing duration of breastfeeding for symptomatic and control infants.

TABLE 4 Age at Introduction of Complementary Foods Given for All Infants (*N* = 123) and for Each Study Group

Variable	All Infants (<i>N</i> = 123)	Food Allergy (<i>n</i> = 41)	Control (<i>n</i> = 82)	<i>P</i> ^a
Median age at introduction of solids, wk				
Any solid/semi-solid food	20	18	20	.044
Interquartile range	17.0–22.0	16.0–21.0	17.0–23.0	
Range	7–28	12–27	7–28	
Duration of concurrent breastfeeding and any solid food	0	0	0	.303
Interquartile range	0.0–9.0	0.0–8.5	0.0–9.75	
Range	0.38	0–38	0–33	
Duration of concurrent breastfeeding and cow's milk in any form	8.0	5.5	9.0	.047
Interquartile range	2.0–20.0	0.0–15.5	3.5–21.5	
Range	0–51	0–51	0–45	
Cow's milk as an ingredient	25.0	22.0	26.0	.049
Interquartile range	21–28.5	17.5–26.5	21.0–29.0	
Range	13–52	13–52	16–52	
Cow's milk in any form	4	3	5	.283
Interquartile range	1.0–14.0	1.0–11.5	1.0–14.3	
Range	1–49	1–49	1–32	
Hen's egg protein	35	39	35	.087
Interquartile range	29.5–40.0	30.0–39.0	29.0–39.0	
Range	17–52	20–52	17–52	
Wheat	27	27	26	.573
Interquartile range	25.0–29.0	24.0–30.0	25.0–29.0	
Range	13–52	13–52	13–50	
Fish	29	29	29	.860
Interquartile range	26.0–34.0	26.0–35.0	26.0–34.0	
Range	17–52	20–52	17–52	
No. (%) of infants who had eaten peanuts before age 52 wk	11 (8.9)	5 (12.2)	6 (7.3)	.055 ^b
No. (%) of infants who had eaten tree nuts before age 52 wk	9 (7.3)	3 (7.3)	6 (7.3)	.309 ^b
No. (%) of infants who had eaten sesame before age 52 wk	13 (10.6)	5 (12.2)	8 (9.8)	.051 ^b

^a Mann-Whitney *U* test comparing infants with food allergy and control infants.

^b χ^2 test.

This analysis found that the association between solid introduction beyond 17 weeks of age and the concurrent breastfeeding and cow's milk introduction and allergy development remained once the effects of other potentially confounding variables were controlled for (odds ratio: 0.292 [95% confidence interval: 0.099–0.859]; odds ratio: 0.279 [95% confidence interval: 0.080–0.971], respectively [data not shown]). However, because a model with 10 variables may be too many for a sample size of 123, the model was reduced by removing the variables that had a small effect (odds ratio between 0.80 and 1.25), and the results are shown in Table 5. Results were similar if the analysis was stratified according

to maternal asthma and maternal allergy (data not shown).

DISCUSSION

Within this nested case-control study, we found that early introduction of solids was associated with the development of food allergy. Infants with food allergy were much more likely to have had solids introduced between 12 and 16 weeks than control infants.

The delayed introduction of solids into the infant diet (particularly of allergenic foods) has in the past been advocated for preventing allergy,¹⁶ but it has led to disappointing results in clinical trials.^{17,18} A number of birth

cohort studies have failed to show any benefit on allergic outcome by delaying the introduction of solids, and 2 found an association between the delayed introduction of milk¹⁹ and egg^{20,21} and increased incidence of eczema and atopic sensitization.^{19–22} However, these studies did not indicate an age before which solids should not be introduced into the diet to avoid allergies. Our findings, conversely, suggest 17 weeks is a crucial time point, with solid food introduction before this time appearing to promote allergic disease whereas solid food introduction after that time point seems to promote tolerance. This finding implies that the mechanism, which acts post-17 weeks of age, is a nonallergen-specific tolerogenic immunologic mechanism because the food diary data showed that the foods introduced at this time were mainly fruit and vegetables, which are not considered allergenic. Epigenetic or immunologic mechanisms may be implicated because the foods that are introduced during this time deliver the substrates required for the induction of such processes.^{23–26} Fruits and vegetables have been shown to modify immune responses in older children,^{19,20} with the proposed mechanism being due to their antioxidant action on inflammatory processes²⁷ and Treg cells²⁸ or their action on the gut microflora.^{29,30}

In addition, we demonstrated a protective effect on food allergy development when cow's milk protein, in whatever form, was given in the infant's diet concurrently with breast milk. One of the perceived benefits of breastfeeding is the reduced risk of allergy due to the presence of a number of immunomodulatory factors in breast milk.^{31–33} However, the evidence that breastfeeding prevents allergies is contradictory, with some reviews showing a benefit while others did not.^{34–38} These findings may be due to

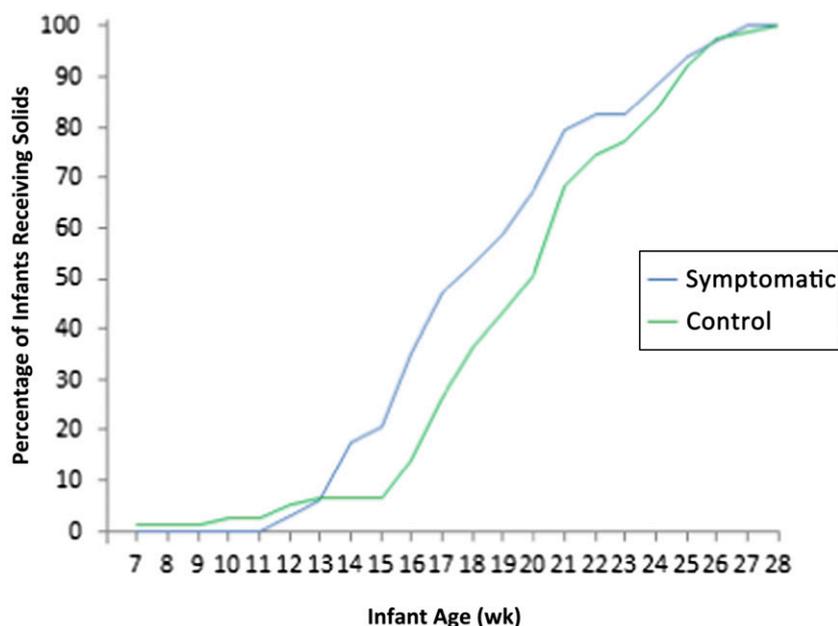


FIGURE 3
Timing of introduction of solids to food-allergic and control infants.

TABLE 5 Adjusted Multivariable Logistic Model for Assessment of Variables Associated With Food Allergy Development

Variable	Adjusted OR (95% CI)
Age at solid introduction (≥ 17 wk vs < 17 wk)	0.245 (0.088–0.679) ^a
Concurrent feeding with breast milk and cow's milk protein (concurrent feeding versus no concurrent feeding)	0.267 (0.086–0.828) ^a
Maternal asthma (no asthma versus asthma)	0.568 (0.177–1.821)
Maternal allergy (no allergy versus allergy)	0.579 (0.226–1.482)

OR, odds ratio; CI, confidence interval.

^a $P < .05$.

variations in breast milk composition, differences in maternal diet,^{39–42} differences in specific infant-feeding practices, or a lack of precision in the way infant feeding has been measured. However, another explanation is that the immunomodulatory role of breast milk is only apparent when the immune system is exposed to an antigen at the same time as breast milk (the “overlap” effect).^{43,44} Breast milk is thought to play an important role in the development of oral tolerance because there are a number of immunologic factors in breast milk, particularly transforming growth factor- β , which has a positive association with infant wheeze³¹; interleukin-12, which promotes Th-1 cytokine milieu³²; and soluble CD14, whose levels in breast milk

have been shown to be negatively associated with eczema at 6 months of age.³³ In the current study, it may be allergen-specific immunoglobulins in the mother's milk that are promoting tolerogenic mechanisms, and this theory is supported by the fact that there was no benefit of overlap seen with “any foods.” It was not possible to determine if there was a similar association for other allergenic food because there were insufficient numbers of infants consuming these foods while still being breastfed. This outcome occurred because wheat, egg, fish, and the other allergenic foods are generally introduced after 26 weeks of age, and 66% of the study mothers had stopped breastfeeding by that time.

Breastfeeding initiation and duration have increased over the last decades,^{45,46} as has the mean age at which solids, particularly allergenic ones, are introduced into the infant diet.^{46,47} Both these changes are due to amended infant-feeding recommendations.^{48,49} The net result of these changes may be that the duration that infants receive solids while still being breastfed (ie, the period of overlap) has been reduced. Consequently, population-wide and allergy-specific infant-feeding recommendations may have had a role in the increase in food allergy rates. A number of countries and specialist bodies now recognize this possibility and have amended their infant-feeding recommendations to incorporate the potential role of concurrent breastfeeding on food allergy development^{50,51}; other professional bodies have called for further research into the topic.^{10,52} The findings from the current study add support to the possible protective effect of concurrent breastfeeding on allergy development and add additional data to the current discussion focusing on the benefits of exclusive breastfeeding (at least until 17 weeks of age).

The main strength of this study is in its design. Infant-feeding data were collected prospectively from birth before any symptoms of food allergy had developed in all but 3 of the food-allergic infants; thus, the likelihood of bias resulting from an allergy diagnosis or by recall error was minimized. In addition, infants were diagnosed as food allergic by using a DBPCFC, considered the gold standard of food allergy diagnosis. However, due to the prospective nature of the diaries, “reverse causality” in the data cannot be ruled out, but early symptoms of food allergy would likely lead to prolonged breastfeeding and delayed solid/allergenic food introduction, which was not seen except for peanut and tree nuts. This

action occurred because parents of allergic children were happier to introduce these foods due to skin prick test results, which control children did not have. Consequently, it is appropriate to consider that this study's findings reflect a possible causal link with food allergy development. A weakness of the study is that the demographic characteristics of the study population differed from the demographic characteristics of the community from which it was recruited. However, the infants in the 2 experimental groups of this study ($N = 123$) did not differ significantly from each other for any demographic or environmental measurement, although due to underpowering (51% for asthma and 43% for maternal allergy), the analysis may not have been able to identify weak associations.

CONCLUSIONS

This study supports current allergy prevention recommendations that solids should not be introduced before 17 weeks of age^{10,11} and the general feeding recommendations that breastfeeding should continue while solids

are introduced into the diet and beyond.¹³ These guidelines are in line with the WHO recommendation for breastfeeding to continue alongside solid foods until 2 years of age.⁵³ However, it does not provide evidence on the relationship between exclusive breastfeeding to 26 weeks of age (compared with 17 weeks) and allergy development because insufficient numbers of women in the study were able to exclusively breastfeed for that long. This situation is reflected in general population data which show that in 2010, only 12% of UK women managed to exclusively breastfeed to 17 weeks.⁴⁶ Exclusive breastfeeding rates in the United States seem to be higher, with 46% of US women exclusively breastfeeding for 3 months,⁴⁵ but this value still falls short of the WHO recommendation. One reason for the low levels of exclusive breastfeeding may be that the recommendations seem to offer conflicting advice.

Although we are waiting for more research to be conducted to determine the optimum duration of exclusive breastfeeding for the best overall health outcome of all infants, health

professionals can provide advice that is consistent by encouraging exclusive breastfeeding for as long as possible, followed by continued breastfeeding alongside the introduction of complementary foods to maximize the duration of concurrent breastfeeding and solid food introduction.

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