

Maternal asthma, infant feeding, and the risk of asthma in childhood

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Controversy surrounds the issue of whether children with asthmatic mothers should be breast-fed. The aim of this study was to investigate whether maternal asthma status alters the association between asthma and breast-feeding. In a cohort study of 2602 West Australian children enrolled before birth and followed prospectively, we collected data on method of infant feeding, maternal asthma (as reported by parental questionnaire), atopy (as measured by skin prick test), and current asthma (defined as a physician's diagnosis of asthma and wheeze in the last year) at 6 years of age. The risk of childhood asthma increased if exclusive breast-feeding was stopped (other milk was introduced) before 4 months (odds ratio, 1.28; 95% CI, 1.01-1.62; $P = .038$), and this risk was not altered by atopy or maternal asthma status. After adjusting for covariates, exclusive breast-feeding for less than 4 months was a significant risk factor for current asthma (odds ratio, 1.35; 95% CI, 1.00-1.82; $P = .049$). There was no formal statistical interaction between breast-feeding and maternal asthma status ($P = .970$). In this study maternal asthma status did not modify the association between asthma and breast-feeding duration. We recommend that infants with or without a maternal history of asthma be exclusively breast-fed for 4 months and beyond. (J Allergy Clin Immunol 2002;110:65-7.)

Key words: Asthma, atopy, maternal asthma, breast-feeding, childhood

In a recent study, after adjustment for covariates, atopic children with asthmatic mothers were significantly more likely to have asthma from the age of 6 years if they had been exclusively breast-fed.¹ In contrast, exclusive breast-feeding was associated with reduced rates of recurrent wheeze in the first 2 years of life, regardless of maternal asthma status or atopy in the child.

We recently reported a risk for doctor-diagnosed asthma, wheeze, and atopy if other milk was introduced before 4 months of age, using data from the Western Australian Pregnancy Cohort Study.² In this report, we examine whether maternal asthma status interacts with the duration of exclusive breast-feeding to alter the risk of current asthma in childhood.

Abbreviation used

OR: Odds ratio

METHODS

Study population

The Western Australian Pregnancy Cohort Study is a prospective birth cohort study that was established between 1989 and 1992 to investigate several hypotheses about antenatal and perinatal antecedents of disease. Details of recruitment and follow-up have been described elsewhere.^{2,3} Briefly, a total of 2979 Western Australian children were enrolled by 18 weeks' gestation. At the time of enrolment, parents completed a questionnaire about their own respiratory illness, smoking behavior, and general health.

Informed consent was obtained for follow-up of the children. A detailed record of perinatal morbidity was obtained, and mothers were issued a diary at discharge to record episodes of illness, feeding history, and other key events in the first year of the child's life. Children were further assessed at 6 years of age. Of 2860 children, 2602 (91%) remained available for follow-up at age 6 years.

Outcomes

Current asthma was defined to reflect its complex definition and definitions of previous research¹ to include asthma as ever diagnosed by a physician and wheeze in the last year.

Atopy was assessed by means of skin prick testing to 4 common environmental aeroallergens (standardized mite, standardized cat pelt, ryegrass [perennial *Lolium perenne*], and mold mix 4 from Bayer Corp), as described by Dreborg⁴ and conducted when the children attended the 6-year clinical assessment. Atopy was defined by a positive skin prick test response if the wheal to at least one of the 4 allergens was 2 mm or larger than that elicited by a control solution 10 minutes after the test.⁵ Analyses that included atopy were restricted to 1595 children undergoing skin testing.

Exposures

Infant feeding was measured as the duration of exclusive breast-feeding defined by the age in months that other milk was introduced in the first year of life (exclusively breast-fed <4 months, exclusively breast-fed ≥ 4 months). The threshold of 4 months was selected because it has been shown to be the time of most relevance in previous studies.² Given that milk is the main food for infants younger than 4 months, the variable did not take into consideration the age that solids were introduced.

The potential covariate exposures were male sex, gestational age of less than 37 weeks, infection exposure (childcare-playgroup attendance in the first 3 months of life and older siblings), concurrent smoking in the household, maternal asthma, and child's atopy status.

When the child was 6 years of age, maternal asthma status was defined as current asthma with wheeze in the last year and use of asthma medication. Other factors considered included maternal age and education, age that solids were introduced, any pet exposure, and family income, although these variables were not included in the final model.

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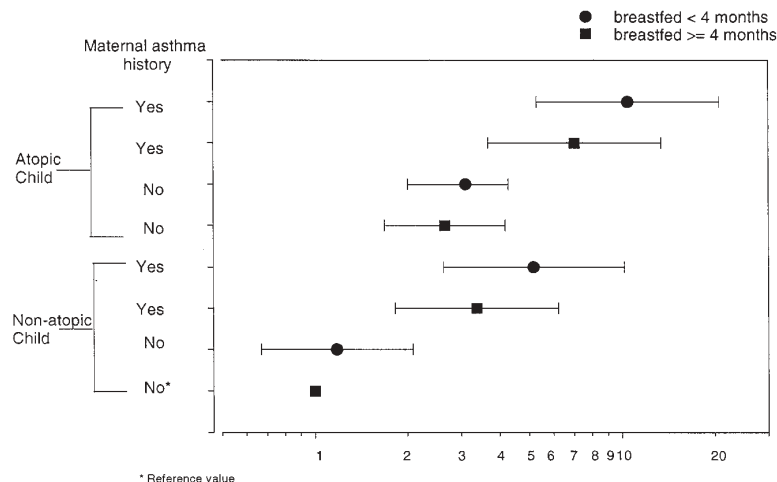


FIG 1. Risk for current asthma by child's atopic status, maternal history, and exclusive breast-feeding on the basis of 1598 children undergoing skin prick tests.

TABLE I. Current asthma (age 6 years), infant feeding category, and maternal asthma status

	Total	Children with asthma			P value (Fisher exact test)
		Exclusive breast-feeding <4 mo	Exclusive breast-feeding ≥4 mo	OR (95% CI)	
Total group	17.0% (336/1980)	18.9% (174/923)	15.3% (162/1057)	1.28 (1.01-1.62)	.038
Maternal asthma	34.7% (103/297)	39.5% (51/129)	31.0% (52/168)	1.46 (0.90-2.36)	.124
No maternal asthma	13.8% (233/1683)	15.5% (123/794)	12.4% (110/889)	1.30 (0.98-1.71)	.065

Statistical analysis

Significance tests for contingency tables were based on the Pearson χ^2 test for association and the Fisher exact test. Unconditional logistic regression was used to compute odds ratios (ORs) and 95% CIs for the multivariate relationship between binary response variables and explanatory exposures of interest, as well as the possible interactions among breast-feeding, maternal asthma, and atopy (χ^2 trend).

RESULTS

Population characteristics

The majority of children (89.3%) were breast-fed, with nearly half (48.4%) exclusively breast-fed for less than 4 months. By age 6 years, 17% of the children had current asthma, 22% had wheeze in the last year, and 31% had physician-diagnosed asthma ever. Of the entire cohort, 15% had mothers with current asthma.

Association among maternal asthma, child's asthma, and infant feeding

Maternal asthma status was significantly associated with increased prevalence of current asthma in the child ($P < .001$). The association between exclusive breast-feeding and asthma was independent of maternal asthma (Table I) and the child's atopic status (Fig 1). Breast-feeding was associated with lower rates of asthma in children of asthmatic mothers and in both atopic and nonatopic children.

After adjustment for sex, gestational age, infection exposure, and concurrent smoking in the household, maternal asthma (OR, 3.42; 95% CI, 2.45-4.78; $P < .001$), the child's atopic status (OR, 2.52; 95% CI, 1.88-3.39; $P < .001$), and the cessation of exclusive breast-feeding before 4 months (OR, 1.35; 95% CI, 1.00-1.82; $P = .049$) were significantly related to current asthma in the child.

A formal statistical interaction term in the logistic regression provided no evidence of any interaction between breast-feeding and maternal asthma status in the association with current asthma ($\chi^2 = 0.5$ on 4 df, $P = .970$). However, as an example, if a child was not atopic, was breast-fed for 4 months or longer, and had a mother with asthma, the association was less (OR, 3.38; 95% CI, 1.83-6.22; $P = .0001$) than if the child was atopic but all other factors were the same (OR, 7.04; 95% CI, 3.68-13.46; $P < .0001$).

DISCUSSION

We did not find any evidence that the child's atopy status or maternal asthma status altered the effect of exclusive breast-feeding for 4 months or longer, which protected against current asthma.

There are a number of strengths of the Western Australian Pregnancy Cohort Study. The cohort was representative of the general population and included very preterm infants. The breast-feeding data were collected prospec-

tively, and follow-up included 91% of eligible children at 6 years. We adjusted for a wide range of potential confounders by using a multivariate analyses. Moreover, the asthma outcome at 6 years was measured as physician diagnosis and wheeze in the last year to identify current illness and to exclude diagnoses on the basis of predominantly infectious wheeze that occurs before this age.

Breast-feeding was associated with lower rates of asthma in children of asthmatic mothers and in atopic and nonatopic children. After adjusting for maternal asthma and child atopic status, we found a consistently protective effect of breast-feeding in contrast to those previously reported for asthma^{1,6} and persistent wheeze.⁷ Although the estimated effects of breast-feeding from studies that have included a measure of maternal asthma might be at the lower end of the effect size range, we found consistently positive associations suggestive of a beneficial effect from breast-feeding. Failure to adjust for maternal asthma might not be the issue, as has been suggested.⁸

In testing the hypothesis of whether infant feeding modulates the risk of childhood asthma, we addressed a question of public health importance that is fundamental to asthma cause. The previously reported study was based on a long-standing cohort that generated a number of key findings regarding the development of childhood respiratory disease and contradictory findings for symptomatic wheeze and active physician-diagnosed asthma.¹ Although the cause of asthma and its relationship with wheeze is complex, it is unlikely that these 2 relationships might truly fall in opposite directions.

Our data suggest a consistent protection conferred by exclusive breast-feeding against current asthma in chil-

dren with asthmatic mothers. Among many other health benefits, breast-feeding provides protection against infection through defense agents in the milk (nutritional, anti-inflammatory, immunologic, and bioactive).^{9,10} Given our findings, we continue to recommend that infants with or without a maternal history of asthma be exclusively breast-fed for 4 months and beyond.

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