

Relation between Breastfeeding and the Prevalence of Asthma

The Tokorozawa Childhood Asthma and Pollinosis Study

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Many risk factors for asthma have been proposed including age, gender (male), smoking, and family history of asthma. The importance of breastfeeding to childhood asthma is a controversial issue. The present study investigated the relation between breastfeeding and the prevalence of asthma among a childhood population. The subjects were 25,767 students, representing all public elementary and junior high schools in Tokorozawa, Japan (age range, 6–15 years). The study population included 2,315 students with asthma and 21,513 controls. Participants' parents completed the Japanese version of the American Thoracic Society and Division of Lung Diseases, National Heart, Lung, and Blood Institute, questionnaire for children adopted by the Japanese Environmental Agency in 1998. The authors added supplementary questions on the parental history of asthma and feeding patterns from the age of 0–3 months. The risk of breastfeeding for asthma was compared with that of artificial feeding. After adjustment for age, gender, parental smoking status, and parental history of asthma, a significantly higher prevalence of asthma was noted among children who had been breastfed (adjusted odds ratio = 1.198; 95% confidence interval: 1.054, 1.363; p for trend < 0.01). The results indicated that breastfeeding in infancy might be related to the higher prevalence of asthma during preadolescence. *Am J Epidemiol* 2001;154:115–19.

asthma; breast feeding; child; questionnaires

There is growing evidence that asthma is becoming more common in Japan, although its prevalence remains relatively low in Japan compared with that in Western countries (1). Because treatment of asthma is somewhat difficult, prophylaxes have been sought.

Many risk factors of asthma have been proposed including age, gender (male), parental smoking, and family history of asthma (2). The importance of breastfeeding to childhood asthma is a controversial issue. In 1936, Grulee and Sanford (3) first reported that breastfeeding protects against infantile eczema. More than half a century since then, many studies have appeared on the role of breastfeeding in the prevention of childhood allergic diseases, for example, asthma (table 1). Several investigators have claimed that breastfeeding is highly protective against asthma (4–6), while many other studies failed to show any significant association (7–16). A few studies suggested that breastfed infants may, rather, be at increased risk for asthma

(17, 18). Many of these studies were based on a relatively small sample population and did not adjust for confounding factors sufficiently.

The present report examines the relation between breastfeeding and “ever having asthma” by a population-based case-control study in Japan.

MATERIALS AND METHODS

Study population

We analyzed data from the Tokorozawa Childhood Asthma and Pollinosis Study, conducted by the Tokorozawa City Municipal Board of Education and the Tokorozawa Medical Association in Saitama, Japan. The Tokorozawa Childhood Asthma and Pollinosis Study investigated the prevalence of childhood asthma and other allergic diseases including pollinosis, an acute recurrent catarrhal disorder caused by allergic sensitivity to specific pollens, and the factors related to these diseases in Tokorozawa.

Tokorozawa is a suburban residential city adjacent to Tokyo. Data were collected between February 2 and 17, 1998, from subjects in grades 1 through 6, including students from all 33 public elementary schools and subjects in grades 1 through 3, including students at 15 junior high schools in Tokorozawa. In all, 25,767 subjects responded to the questionnaire among 28,848 students (response rate = 89.3 percent). Active parental consent for participation was obtained in the form of written permission.

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TABLE 1. Previous studies on the association between childhood asthma and breastfeeding

Investigators (ref*)	No. of subjects	Age range	Measurement of breastfeeding	Measurement of asthma
Negative association				
Saarinén et al. (4)	256	0–3 years	Feeding history at clinics	Wheezing history at clinics
Hide and Guyer (5)	843	12 months	Questionnaire	Questionnaire (asthma or bronchitis)
Raisler et al. (6)	7,092	6 months	Questionnaire	Questionnaire (cough or wheeze)
No association				
Halpern et al. (7)	1,753	6 months–7 years	Feeding history at clinics	Physician diagnosed (asthma)
Gordon et al. (8)	250	2 years	Feeding history at clinics	Physician diagnosed (eczema-asthma syndrome)
Golding et al. (9)	13,135	5 years	Questionnaire	Patients' report (asthma)
Fergusson et al. (10)	1,110	4 years	Structured interview	Structured interview (asthma)
Taylor et al. (11)	13,135	5 years	Questionnaire	Structured interview (asthma)
Midwinter et al. (12)	457	5 years	Questionnaire	Structured interview (asthma)
Cogwell et al. (13)	73	5 years	Diary	Physician diagnosed (wheeze)
Zeiger et al. (14)	288	2 years	Follow-up study	Physician diagnosed (asthma)
Lucas et al. (15)	777	18 months	Follow-up study	Physician diagnosed (asthma or wheeze)
Gustafsson et al. (16)	736	7 years	Follow-up study	Medical record review (asthma)
Positive association				
Martin et al. (17)	342	21 years	Questionnaire	Physician diagnosed (asthma)
Savilahti et al. (18)	183	2 years	Feeding history at clinics	Wheeze history taken at clinic

* Ref, reference number.

Measurement

The questionnaire used in this study was the Japanese version of the American Thoracic Society and Division of Lung Diseases, National Heart, Lung, and Blood Institute, questionnaire for children (19). The questionnaire has been adopted by the Japanese Environmental Agency and includes a few additional items related to job history, dust exposure, ocular symptoms, family member smoking status, and exposure to other indoor air pollution (20). We added supplementary questions on parental history of asthma and feeding patterns from the age of 0–3 months.

The questionnaire along with a consent form was distributed through the Tokorozawa City Municipal Board of Education. The parents were asked to complete it, and completed questionnaire and consent forms were collected 1–2 weeks later.

The definition of asthma used in this study is the one proposed by the Japanese Environmental Agency (20). The reliability and validity of the American Thoracic Society and Division of Lung Diseases, National Heart, Lung, and Blood Institute, questionnaire to identify children with asthma has been well established (21, 22).

The criteria for asthma (“ever having asthma”) were met by a “yes” response to all of the following questions: 1) Has your child ever had an attack of wheezing that has caused him/her to be short of breath? 2) Has your child had such an attack twice or more? 3) Has a physician ever informed you that your child has asthma? 4) If so, at that time, did your child have shortness of breath with wheezing? The subjects who had never had asthma, including the children who answer one, two, or three of the questions to define asthma, were used as controls.

In this report, we focused on the comparison between subjects with asthma and controls in order to clarify the risk of breastfeeding for asthma. To this end, 1,939 subjects were excluded because of insufficient answers on the questionnaire. In total, 12,105 boys and 11,723 girls, aged 6–15 years, were eligible for the following analysis.

Positive parental smoking was defined as having a mother or father who smoked one or more cigarettes per day at the time of the survey. Subjects whose mother or father had ever been treated for asthma were defined as having a positive parental history of asthma. Feeding patterns from the age of 0–3 months were classified into “breastfeeding only,” “mixed,” or “artificial feeding.”

Statistical analysis

The characteristics of subjects with or without asthma were examined by the chi-squared test or Student's *t* test.

To control for confounding factors such as age, gender, parental smoking, and parental history of asthma, we used multiple logistic regression analysis. We used artificial milk users as the reference to investigate the effect of breastfeeding on the prevalence of asthma. We also conducted a test of trend for the dose-response relation.

Reported *p* values were all two tailed. All data were stored and analyzed using SAS version 6.12 software (23, 24) on an IBM computer (International Business Machines Corporation, Armonk, New York).

RESULTS

Table 2 shows the comparison between subjects with asthma (*n* = 2,315) and controls (*n* = 21,513) according to

TABLE 2. Comparison between subjects with asthma ($n = 2,315$) and controls ($n = 21,513$), according to selected risk factors, Tokorozawa Childhood Asthma and Pollinosis Study, Japan, February 2–17, 1998

Variables	Asthma (mean (SD*))		Controls (mean (SD))		p value
Age (years)	10.71 (2.45)		10.77 (2.53)		0.30†
	No.	%	No.	%	
Gender					<0.01‡
Male	1,429	61.7	10,676	49.6	
Female	886	38.3	10,837	50.4	
Parental smoking					0.14‡
(+)	1,254	54.2	11,997	55.8	
(–)	1,061	45.8	9,516	44.2	
Parental history of asthma					<0.01‡
(+)	522	22.6	1,898	8.8	
(–)	1,793	77.4	19,615	91.2	
Feeding pattern					<0.01‡
Breastfeeding only	992	42.9	8,620	40.1	
Mixed	966	41.7	9,134	42.4	
Artificial feeding	357	15.4	3,759	17.5	

* SD, standard deviation.

† p value for t test.‡ p value for chi-squared test.

age, gender, parental smoking, parental history of asthma, and feeding patterns. Subjects with asthma were found more likely to be male, to have a parental history of asthma, and to have been breastfed. No difference in parental smoking status was observed between subjects with asthma and controls.

Table 3 presents the adjusted odds ratios and 95 percent confidence intervals for asthma according to the selected risk factors. After adjustment for age, gender, parental smoking status, and parental history of asthma, a significantly low risk of asthma was still noted among artificial milk feeders.

Table 4 indicates that the prevalence of asthma increased with the increase of the effect of breastfeeding significantly.

DISCUSSION

This study investigated the relation between breastfeeding and asthma. We found that breastfeeding in infancy might be positively related to the prevalence of asthma during preadolescence. Findings on the effect of breastfeeding with regard to asthma have been inconsistent (table 1). Two previous studies obtained results supporting a positive association (17, 18), other studies failed to find any association (7–16), and several studies found a protective effect of breastfeeding against asthma (4–6). The findings of the present study supported the study remarked; that is, a positive association was found.

The mechanism of the unfavorable effect of breastfeeding on asthma is unknown. One hypothesis is that fat-soluble chemicals accumulating in breast milk might induce asthma.

TABLE 3. Adjusted odds ratios* and 95% confidence intervals for subjects with asthma according to the selected risk factors, Tokorozawa Childhood Asthma and Pollinosis Study, Japan, February 2–17, 1998

Variables	Adjusted odds ratio	95% Confidence interval	p value
Age	1.000	0.986, 1.020	0.75
Gender			
Male	1.653	1.513, 1.808	<0.01
Female	1.000		
Parental smoking			
(+)	0.945	0.866, 1.032	0.21
(–)	1.000		
Parental history of asthma			
(+)	3.028	2.714, 3.377	<0.01
(–)	1.000		
Feeding pattern			
Breastfeeding only	1.198	1.054, 1.363	<0.01
Mixed	1.090	0.958, 1.239	0.19
Artificial feeding	1.000		

* The logistic regression analysis was applied to adjust for the other risk factors.

If this mechanism is correct, children higher in the birth order would be more likely to have asthma (25). However, additional adjustment for birth order did not affect the asso-

TABLE 4. Relation between feeding patterns and prevalence of asthma, Tokorozawa Childhood Asthma and Pollinosis Study, Japan, February 2–17, 1998

Feeding patterns	Prevalence of asthma (%)
Breastfeeding only	10.32
Mixed	9.56
Artificial feeding	8.67
<i>p</i> for trend	<0.01

ciation between asthma and breastfeeding (adjusted odds ratio = 1.212; 95 percent confidence interval: 1.057, 1.389; $p < 0.01$). This indicates that this hypothesis is not supported. Another hypothesis is sensitization through breast milk. Foreign protein antigens can be transmitted in breast milk (26, 27). These antigens may provoke hypersensitivity. In fact, a study showed that this type of sensitization was seen in 10 percent of breastfed infants (28).

The large number of subjects increases the power of the analysis in this study. Further, several aspects of homogeneity were advantageous for the purpose of our analysis. For example, subjects represented all public elementary and junior high schools in Tokorozawa and can be considered representative of most 6- to 15-year-old children in this area. Given that there are no private elementary or junior high schools in Tokorozawa, the selection bias according to socioeconomic differences and the demand for higher quality of education might be minimal. Important confounding factors were obtained in this study, which was not the case in previous reports. Adjustment for these confounding factors is expected to clarify the independent association between asthma and breastfeeding.

Our findings must be viewed in conjunction with several limitations of the study design; parental recall could have affected the accuracy of data on breastfeeding patterns, particularly if memory varied with the length of the recall period. Breastfeeding and nonbreastfeeding mothers might recall events differently (29, 30). Moreover, parental recall bias may lead to underdetection of the association between breastfeeding and asthma in the event that mothers whose children are asthmatic subconsciously emphasize having breastfed out of guilt. The limitation of our statistical methods is the small number of the reference for analysis of the association between feeding pattern and asthma ($n = 4,116$). Although the reference is preferred to a large number, we used artificial milk users as the reference because we would like to know the effects of “any exposure to breast milk” versus none on the prevalence of asthma. When we recalculated the adjusted odds ratio to see the effect of exclusive breastfeeding on the prevalence of asthma, in a comparison of subjects with mixed- or artificial-milk feeding, we obtained a similar result (adjusted odds ratio = 1.126; 95 percent confidence interval: 1.031, 1.230; $p < 0.01$). In addition to the degree of exclusivity, the duration of breastfeeding should be considered in this kind of study. We used 3 months as the cutoff point of duration of breastfeeding

because several studies used 3 months as the criterion of duration (8, 9, 11, 17).

This study showed no difference in parental smoking status between asthmatic subjects and controls. Furthermore, no differences in maternal or family smoking status were also observed between the cases and controls (data not shown). An epidemiologic study in Japan reported no association between the prevalence of asthma and family smoking (31). Analysis using data on current smoking status might indicate no significant effect of smoking status on the prevalence of “ever having asthma” in this study. Unfortunately, we cannot evaluate the effect of smoking on the incidence of asthma because there were no data on parental smoking status at the incidence of their children’s asthma.

In conclusion, breastfeeding in infancy might be related to the higher prevalence of asthma during preadolescence. Although an epidemiologic study such as this cannot provide definitive evidence of the risk of breastfeeding on the prevalence of asthma, our findings show the possibility of its undesirable effect.

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