

Duration of breast-feeding and the risk of childhood allergic diseases in a developing country

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ABSTRACT

Exclusive breast-feeding (EBF) seems to reduce risk of allergies in the western countries, but there are few reports from developing countries. The purpose of this study was to assess the effect of EBF on the development of allergic diseases and eczema in a developing country. This is a cross-sectional survey done at the well-baby clinics of 11 primary health centers, Hamad Medical Corporation, Qatar. A multistage sampling design was used and a representative sample of 1500 children (0–5 years old) and mothers (18–47 years old) were surveyed between October 2006 and September 2007. Of them, 1278 mothers (85.2%) participated in the study. A confidential, anonymous questionnaire assessing breast-feeding and allergic diseases was completed by mothers bringing children for immunization. Questionnaire included allergic rhinitis, wheezing, eczema, type and duration of breast-feeding, parental smoking habits, number of siblings, family income, maternal education, and parental allergies. Univariate and multivariate statistical methods were performed for statistical analysis. More than one-half of the infants (59.3%) were on EBF. Length of breast-feeding was associated with maternal age. Prevalence of eczema (19.4%), allergic rhinitis (22.6%), and wheezing (12.7%) were significantly less frequent in those with prolonged (>6 months) compared with short-term fed infants. The association between EBF and eczema tended to be similar in children with a positive family history of atopy ($p < 0.001$) and eczema ($p < 0.001$) compared with those without. In children of developing countries, prolonged breast-feeding reduces the risk of developing allergic diseases and eczema even in the presence of maternal allergy, where it might be a practical, effective preventive measure.

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Key words: Allergic rhinitis, allergies, breast-feeding, children, eczema, Qatar, questionnaire, risk factors, wheezing

Allergic disorders including bronchial asthma, allergic rhinitis, and eczema are quite common among children worldwide.¹ In many developing countries, the prevalence of allergic diseases and eczema is higher than that in developed countries,^{2,3} because of many factors, including consanguineous marriages.⁴ It affects as many as 20% of young children^{2,3} and is associated with a significant morbidity and high economic impact on health resources.⁵ Therefore, primary prevention of these allergies through cost-effective strategies, such as breast-feeding has been the focus of numerous studies in the last few decades.^{6–8} Although results of these studies are “conflicting” or inconsistent, for many reasons, the main body of evidence is in favor of the protective role of breast-feeding.^{9,10}

Breast milk is considered ideal nutrition and provides advantages regarding general health, growth, and development and psychological and social benefits.¹¹ Being readily available and relatively of low cost, breast milk makes breast-feeding an effective preventive measure against developing allergic diseases.¹² In 2003 the World Health Organization issued a revised global recommendation that mothers should breast-feed exclusively for 6 months.

This recommendation is likely to influence national policies on the recommended age for the first introduction of solids, so it is important that pediatricians are aware of the issues and the evidence on which the World Health Organization recommendation is based.¹³ The fact that 4–6 months of exclusive breast-feeding (EBF) might be protective against developing an allergic disease is an ideal primary preventive strategy, especially for developing countries where health economic resources are usually limited. Unfortunately, there is paucity of data from the developing countries on the role of breast-feeding in prevention of allergies and eczema.^{14,15}

SUBJECTS AND METHODS

This is a cross-sectional study on infants and pre-school children from urban and semiurban areas of Qatar. It was approved by the Medical Ethics Commit-

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tee of Hamad General Hospital, Hamad Medical Corporation.

The sample comprised Qatari male and female children who were 0–5 years old. Children were attending regular visits with their parents at the Immunization Program of well-baby clinics of the 11 primary health care centers (PHCCs), Hamad Medical Corporation, State of Qatar. The sample was adjusted proportional to those from each clinic by a systematic sampling technique. The sampling plan controlled the factors underlying heterogeneity among PHCC visit such as age, sex, and socioeconomic level. Accordingly, the sampling plan included stratification based on these variables, together with multistage sampling. The infants and children who were sampled from each PHCC were chosen with probability proportional to the substrata sizes by a simple random sample. A multistage sampling design was used and a representative sample of 1500 infants and preschool children (0–5 years) and their mothers (18–47 years old) were surveyed during the period from October 2006 to September 2007. A total 1278 mothers (85.2%) gave consent to participate in this study.

Again, we had a double confirmation on the data obtained on asthmatic children by using the modified version of the International Study of Asthma and Allergies in Childhood questionnaire,¹⁶ and Bener's Questionnaire.¹⁷ The questionnaires with a letter of explanation in Arabic were distributed to the parents of these children, who lived in either urban or semiurban areas of Qatar. A confidential, anonymous questionnaire was completed by the child's parent assessing breast-feeding and allergic diseases. The questionnaire included allergic rhinitis, wheezing, eczema, and additional questions such as type and duration of breast-feeding, parental smoking, number of siblings, family income, maternal education, and allergic history of parents or siblings.

Before the commencement of this study, the repeatability of the questionnaire was determined in a separate study by one of us (A.B.). The assessment of repeatability of the questionnaire was through the use of κ -values, average correct classification rate, and the proportion in agreement. Responses to the questionnaire showed a high degree of repeatability between the first and second questionnaires and most questions showed excellent agreement. No alteration was made to the questionnaire before its use in the main study sample. Meanwhile, content validity, face validity, and reliability of the questionnaire were tested in all allergic disease patients who showed high levels of validity and a high degree of repeatability ($\kappa = 0.83$); 78% of self-reported allergic diseases were confirmed in medical charts or HMC/PHCC Clinics Health ID Card.

Breast-feeding was defined by the question, "How was he/she fed in the first 6 months of life?" in the

current survey. The parent could answer (1) breast-fed only, (2) bottle-fed only, or (3) breast-fed and bottle-fed. *Exclusively breast-fed* was defined as the breast-fed only group. *Ever asthma* was defined as a positive response to the question, "Has he/she at any time in his/her life suffered from repeated attacks of asthma or wheezy breathing?" *Infantile eczema* was defined as a positive response to the question, "Did he/she have infantile (baby) eczema?" in the current survey. *Food allergies* were defined as a positive response to the question, "Have you been told by a doctor that he/she is allergic to any foods or medicines?" in the current study. *Specific allergies* to food, medicines, dust, animals, or pollens were defined as a positive response to the question, "Have you ever been allergic to (a) food; (b) medicines; (c) dust; (d) animals; and/or (e) pollen, grass, trees, or flowers?" in the current survey. *Ever eczema* was defined by the question, "Have you ever had eczema or any kind of dry itchy skin disease?" as reported in the previous survey in Qatar. *Ever allergic rhinitis* was defined as a positive response to the question, "Have you ever had hay fever (i.e., sneezing, runny, or blocked nose when you do not have a cold or flu)?" in the current study.

The questions concerning the diagnosis of asthma were "Has the child ever been diagnosed as having asthma by a doctor?", and "Has the child ever needed treatment or hospital admission due to asthma?" The diagnosis of allergic rhinitis was based on questions, "Has your child ever had a problem with frequent sneezing or prolonged blocked nose during the last 6 months when he/she did not have a cold or flu? The questions concerning the diagnosis of persistent eczema were as follows: "Has your child ever had a dry and itchy red rash for at least 3 months?"

Student's *t*-test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by nonparametric Mann-Whitney test. Crude associations between EBF and current asthma and other atopic diseases were evaluated using χ^2 -tests and by computing crude odds ratios (OR) and corresponding 95% confidence interval (CI). In 2×2 tables, the Fisher's exact test (two-tailed) was used instead of χ^2 , in particular, when the sample size was small. The level of $p < 0.05$ was considered as the cutoff value for significance.

RESULTS

Of the 1278 infants included in the study, more than one-half of them (758 [59.3%]) were exclusively breast-fed. Length of breast-feeding was associated with maternal age (29.1 ± 5.6 years, mean $\pm$ SD) Table 1 depicts sociodemographic characteristics of children surveyed. There was a significant difference between the two groups in term of birth order of the child, paternal smoking habits, and consanguinity.

Table 1 Baseline and sociodemographic characteristics of 1278 study children

Characteristic	EBF (%)	Non-EBF (%)	<i>p</i> Value
Number	758 (59.3)	520 (40.7)	
Child's gender			
Male	359 (47.4)	273 (52.5)	NS
Female	399 (52.6)	247 (47.5)	
Child's birth order			
1–2	355 (46.8)	253 (48.7)	<0.001
3–4	287 (37.9)	192 (36.9)	
5–8	116 (15.3)	75 (14.4)	
Parental consanguinity			
Yes	249 (32.9)	200 (38.5)	0.024
No	508 (67.1)	320 (61.5)	
Maternal age group (yr)			
<25	195 (25.7)	134 (25.8)	NS
25–34	444 (58.6)	307 (59.0)	
≥35	119 (15.7)	79 (15.2)	
Maternal educational level			
University	115 (15.2)	71 (13.7)	NS
High school	88 (11.6)	51 (9.8)	
Secondary school	110 (14.5)	85 (16.3)	
Primary school	300 (39.6)	217 (41.7)	
Illiterate	145 (19.1)	96 (18.5)	
Maternal occupation			
Housewife	549 (72.4)	375 (72.1)	NS
Professional	146 (19.3)	101 (19.4)	
School teacher	53 (7.0)	36 (6.9)	
Police/security officer	10 (1.3)	8 (1.5)	
Family income			
Low (<2750 US\$/mo)	172 (22.7)	129 (24.8)	NS
Medium (2750–4130 US\$/mo)	383 (50.5)	260 (50.0)	
High (>4130 US\$/mo)	203 (26.8)	131 (25.2)	
Passive smoke exposure			
Smoking father			
Yes	206 (27.2)	174 (33.5)	0.009
No	552 (72.8)	321 (66.5)	
Smoking mother			
Yes	55 (7.3)	25 (4.8)	0.047
No	703 (92.7)	495 (95.2)	
Accommodation			
Villa	208 (27.4)	135 (26.0)	NS
Semivilla	276 (36.4)	190 (36.5)	
Traditional house	125 (16.5)	75 (14.4)	
Apartment	149 (19.7)	120 (23.1)	

EBF = exclusive breast-feeding.

Table 2 reveals prevalence of allergic diseases in these children according to the mode of feeding. Eczema (19.4%), asthma (15.6%), allergic rhinitis (22.6%), and wheezing (12.7%) were significantly less frequent in those prolonged and EBF, compared with those who were non-EBF and short-term-fed infants, respectively. Table 3 shows a relationship between the breast-feed-

ing mode and family history of allergic diseases. The association between breast-feeding and asthma, wheeze, allergic rhinitis, and eczema tended to be similar in children with a positive family history of allergic diseases such as physician-diagnosed asthma, wheeze, allergic rhinitis ($p < 0.001$), and eczema ($p < 0.001$) compared with those without a family history of aller-

Table 2 Prevalence of allergic diseases in 1278 children surveyed.

Allergic Disease	EBF (%)	Non-EBF (%)	OR (95% CI)	<i>p</i> Value
Number	758 (59.3)	520 (40.7)		
Asthma*	118 (15.6)	139 (26.7)	1.98 (1.49–2.63)	0.001
Wheeze	96 (12.7)	90 (17.3)	1.44 (1.04–2.00)	0.024
Allergic rhinitis	171 (22.6)	178 (34.2)	1.79 (1.38–2.31)	0.0001
Eczema	147 (19.4)	143 (27.5)	1.58 (1.20–2.07)	0.0001

*Physician-diagnosed asthma.

EBF = exclusive breast-feeding.

Table 3 Relationship between the breast-feeding mode and parental history of atopy

Type of Allergy	Maternal Atopy				Paternal Atopy			
	EBF (<i>n</i> ; %)	Non-EBF (<i>n</i> ; %)	OR (95% CI)	<i>p</i> Value	EBF (<i>n</i> ; %)	Non-EBF (<i>n</i> ; %)	OR (95% CI)	<i>p</i> Value
Any allergic disease	231 (34.3)	203 (39.0)	1.46 (1.14–1.85)	0.001	224 (29.5)	194 (37.3)	1.41 (1.11–1.81)	0.0001
Asthma*	81 (3.3)	71 (6.5)	1.17 (0.92–1.88)	0.127	64 (8.4)	48 (9.2)	1.10 (0.73–1.66)	0.697
Allergic rhinitis	173 (3.3)	125 (6.5)	1.16 (1.00–1.34)	0.028	136 (17.9)	125 (24.0)	1.23 (1.06–1.43)	0.005
Eczema	149 (3.3)	141 (6.5)	1.27 (1.10–1.46)	0.001	129 (17.0)	107 (20.6)	1.14 (0.97–1.34)	0.063

*Physician-diagnosed asthma.

EBF = exclusive breast-feeding.

Table 4 Risk of allergic diseases in children in relation to the mode of breast-feeding

Type of Allergy	EBF (%)	Non-EBF (%)	OR (95% CI)	<i>p</i> Value
Allergy to medications	25 (3.3)	34 (6.5)	1.45 (1.50–1.81)	0.005
Allergy to foods	106 (14.0)	130 (25.0)	1.47 (1.28–1.69)	0.001
Allergy to pollens	13 (1.7)	25 (4.8)	1.64 (1.30–2.09)	0.001
Allergy to pets	72 (9.5)	96 (18.5)	1.50 (1.29–1.74)	0.0001
Allergy to dust	28 (3.7)	42 (8.1)	1.51 (1.23–1.86)	0.001

EBF = exclusive breast-feeding.

gic diseases. Table 4 shows risk of allergic diseases in EBF children surveyed versus non-EBF children. Figure 1 shows the prevalence of phenotypes of allergic diseases in children with short-term (<6 months) and prolonged (≥ 6 months) breast-feeding duration.

DISCUSSION

This large, cross-sectional study indicates that exclusive prolonged breast-feeding for the first 6 months of life reduces the risk of allergic diseases among children. This protective effect was quite obvious against eczema, asthma, and allergic rhinitis. These results are consistent with several recent studies from developed countries that revealed the breast-feeding to be associated with decreased risks of these diseases.^{9,18–20}

In their comprehensive meta-analysis of prospective studies on the possible protective effect of breast-feed-

ing against the onset of atopic dermatitis during childhood, Gdalevich *et al.*⁹ concluded that breast-feeding during the first 3 months of life is associated with lower incidence rate of atopic dermatitis in children with appositive family history. They strongly recommended atopic mothers to breast-feed their infants to prevent atopic eczema. Kull *et al.*,¹⁹ in their large birth cohort involving 4089 infants in Sweden, revealed that EBF is protective on the early development of asthma, allergic rhinitis, and atopic dermatitis among children until the age of 2 years old. In a multidisciplinary review of the literature (1966–2001) on the mode of early feeding in infancy and its impact on late atopic diseases, there was a reduction in the risk of asthma and recurrent wheezing.¹⁰ This effect was proportional to duration of feeding and seems to persist at least during the first 10 years of life.¹⁰

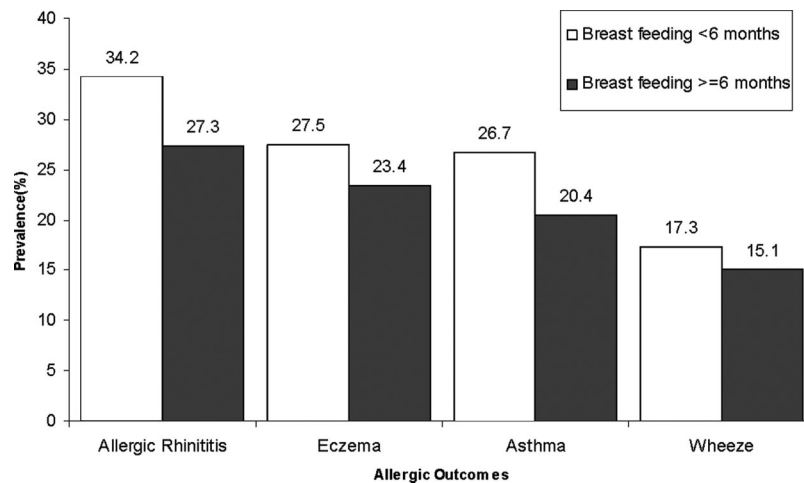


Figure 1. Prevalence of allergic diseases phenotypes in children with short-term (<6 months) and prolonged (≥6 months) breast-feeding duration.

Our study revealed that this EBF is protective against eczema and allergic diseases even the presence of positive family history of/or maternal atopy, strong risk factors for allergic diseases in early childhood.^{9,21–23} This result supports the growing literature from developing countries. Setiabudiawan *et al.*²⁴ found that EBF for 6 months is strongly protective against atopy in Indonesian children regardless of family history. Herag¹⁵ concluded that EBF for at least 8 months was helpful in reducing the prevalence of atopic diseases in Moroccan children. In a case-control study on 100 Iranian children with atopic dermatitis compared with 100 controls, Ghaderi *et al.*¹⁴ found that EBF was protective against development of atopic dermatitis compared with children who were fed cow's milk. Interestingly, Mai *et al.*²⁵ found that EBF for <12 weeks was significantly associated with development of asthma and overweight in preadolescents.

In contrast, there are several studies suggesting that prolonged EBF increases the risk for development of allergic diseases.^{26–30} However, data on the protective role of EBF in development of atopic eczema in children is less divergent than that in asthma or other allergies.²⁰ This inconsistency of literature possibly could be explained by differences among various studies in respect to methodological factors, design, and study outcome measures³¹; presence or absence of family atopy or maternal atopy; role of environmental allergens or pollutants; and composition of breast milk between nonallergic and allergic mother.^{32,33} In addition, reverse causation (*i.e.*, tendency of mothers to breast-feed infants with early signs of an allergic disease) might have influenced the outcome of some of these studies that lacked adjustment for family history of atopy. Reverse causation might lead to a spurious association between breast-feeding and increased risk of allergic diseases or masks the protective effect of prolonged breast-feeding.³⁴

A major strength of our study is that to the best of our knowledge, this is the first study from a developing country with such a large sample size on breast-feeding and risk of allergic diseases and eczema. Because of study design, recall bias, might have been inevitable. We tried to reduce it by enrolling young age groups of children attending well-baby clinic and immunization programs. In addition, we used questions of the standardized questionnaire.

Lack of documentation atopy or sensitization (serum IgE, skin test reactivity to allergens, or *in vitro* tests such as radioallergosorbent test) in these children or their parents could be looked at as one of limitations of this study. This study did not consider atopy as an outcome measure because family history is the strongest risk factor for the development of allergies/asthma^{35,36} and atopy does not imply a clinically relevant allergic disease.^{37,38}

CONCLUSIONS

In conclusion, the results of this study indicate that prolonged breast-feeding and EBF reduces the risk of eczema and allergic diseases in children even in the presence of maternal allergy. Therefore, breast-feeding is likely to be of great relevance in the prevention of allergic diseases, particularly in developing countries where the prevalence of allergic diseases is rising and the health resources usually are limited.

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