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ROLE OF BREAST FEEDING IN PRIMARY PREVENTION OF ASTHMA AND ALLERGIC DISEASES IN A TRADITIONAL SOCIETY

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SUMMARY:

• **Background:** The fact that breastfeeding may protect against allergic diseases remains controversial, with hardly any reports from developing countries. Prolonged breastfeeding was shown to reduce the risk of allergic and respiratory diseases.

• **Aim:** The aim of this study was to assess the relationship between breastfeeding and the development of childhood asthma and allergic diseases in Qatari children at age 0-5 years. Additionally, this study investigated the effect of prolonged breastfeeding on the allergic diseases in a developing country.

• **Design:** This is a cross sectional survey.

• **Setting:** Well baby clinics and Pediatric clinics in the 11 Primary Health Care Centers and Hamad General Hospital, Hamad Medical Corporation, State of Qatar.

• **Subjects:** A multistage sampling design was used and a representative sample of 1500 Qatari infants and pre-school children with age range of 0-5 years and mothers aged between 18 to 47 years were surveyed during the period from October 2006 to September 2007 in Qatar. Out of the 1500 mothers of children, 1278 mothers agreed to participate in this study with the response rate of 85.2%.

• **Methods:** A confidential, anonymous questionnaire was completed by the selected subjects assessing breastfeeding and allergic diseases. Questionnaires were administered to women who were visiting Primary Health Centers for child immunization. Questionnaire included allergic rhinitis, wheezing, eczema, and additional questions included mode and duration of breastfeeding, tobacco smoke exposure, number of siblings, family income, level of maternal education, parental history of allergies. Univariate and multivariate statistical methods were performed for statistical analysis.

• **Results:** More than half of the infants (59.3%) were exclusively breastfed, followed by infants with partial breastfeeding (28.3%) and artificial fed (12.4%). There was a significant difference found across these three categories of infants in terms of their age groups, smoking status of father, socio-economic status and parental consanguinity. Asthma (15.6%), wheezing (12.7%), allergic rhinitis (22.6%) and eczema (19.4%) were less frequent in exclusive breast fed children, compared to infants with partial breast feeding and formula milk. Ear infection ($P=0.0001$) and eczema ($P=0.007$) were found significant in infants with the history of maternal atopy, while asthma ($P=0.0001$) and allergic rhinitis ($P=0.015$) were found significant in infants with the history of paternal atopy. The main associated factors with mode of feeding were mothers having first baby, mother with asthma and parental history of allergic rhinitis. The risk of allergic diseases in children, eczema, wheeze and ear infection in particular, were lower in children with prolonged breastfeeding (>6months) than in those with short breastfeeding duration (<6months).

• **Conclusion:** The current study indicates that exclusive breast-feeding prevents development of allergic diseases in children. The main factors associated with breastfeeding for allergic diseases were being the first baby, maternal history of asthma, and parental history of allergic rhinitis. The study findings opens a big avenue for interventional role of breastfeeding. Therefore, we recommend as one possible way to reduce the risk of onset asthma and allergic diseases in developing countries.

Key Words: Breastfeeding. Children. Asthma. Allergic diseases. Risk factors. Qatar.

Abbreviations: EBF: Exclusive breastfeeding, PF: partial feeding, FF: formula feeding

INTRODUCTION

Asthma is the single most common chronic childhood disease worldwide, and its prevalence and severity have been increasing in several countries (1-7).

In addition to its morbidity and effects on quality of life, asthma has a high impact on health resources.

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Breast milk is considered an ideal nutrition and provides advantages regarding general health, growth and development, psychological and social benefits, readily available and relatively of low cost. Through immunologic mediators, it is protective against various infections, and allergic disorders (8). Therefore, primary prevention of allergic diseases including asthma, through cost effective strategies has been the focus of numerous studies (9-21).

Although several others have suggested that breastfeeding may not offer a protective effect in later life or may even enhance the development of allergic disease (7-12), the main body of evidence favors the protective role of breast feeding against, asthma or allergic disease including eczema (13-24).

A systematic review of 12 prospective studies found that exclusive breastfeeding in the first months of life was associated with reduced rates of asthma and that the protective effect was greatest in high-risk children (22). Another recent multidisciplinary review examined more than 4000 articles related to breast-feeding and allergic disease and concluded that breast-feeding in the first 4 months of life reduced the risk of asthma (23). Almost all of these studies have been from developing countries, with hardly any data from developing countries. Hence, the aim of this study was to assess role of breastfeeding in the development of childhood asthma and allergic diseases in this developing country.

SUBJECTS AND METHODS

The infant and pre-school children studied were the subjects of this cross-sectional population study conducted in both urban and semi-urban areas of Qatar. Approval for the study was obtained from the Medical Ethics Committee of the Hamad General Hospital, Hamad Medical Corporation.

The sample comprises of Qatari male and female children in the age group (0-5) years. The study performed at the Well Baby clinics in the 11 Primary Health Care Centers (PHCC) of the Hamad Medical Corporation, State of Qatar. The PHCC sample was adjusted proportional to these from each clinic obtained from the daily visits for immunization and well baby clinics by systematic sampling technique. The sampling plan controlled the factors underlying heterogeneity among PHCC visit such as age, sex and socio-economic 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 pre-school children with age range of 0-5 years and mothers aged between 18 to 47 years were surveyed during the period from October 2006 to September 2007 in Qatar. A total of 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 [ISAAC] questionnaire (1-3) and Bener's Questionnaire (4). The questionnaires with a letter of explanation in Arabic were distributed to the parents of these children, who were lived in either urban or semi-urban areas of Qatar. A confidential, anonymous questionnaire was completed by children's mothers assessing breastfeeding and allergic diseases. Questionnaires were administered to

mothers bringing children to PHCC for immunization. Questionnaire included allergic rhinitis, wheezing, eczema, and additional questions included mode and duration of breastfeeding, paternal & maternal smoking habits, number of siblings, family income, level of maternal education, and family history allergies. Breast-feeding was defined by the question, "How was he/she fed in the first three months of life?" in the current survey. The parent could answer (1) breastfed 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 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) foods; b) medicine; c) dust; d) animals; 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 skin allergy?" 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 (that is sneezing, running 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 six 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 6 months?

Student-t test was used to ascertain the significance of differences between mean values of two continuous variables and confirmed by non parametric Mann-Whitney test. Crude associations between exclusive breast-feeding and current asthma and other atopic diseases ever were evaluated using χ^2 tests and by computing crude odds ratios (OR) and corresponding 95% Confidence Interval (CI) .. In 2x2 tables, the Fisher exact test (two-tailed) was used instead of Chi-Square, in particular, when the sample size was small. We used multiple logistic regression models to estimate the effect of exclusive breast-feeding on current asthma and allergic diseases and

other outcome variables, adjusting for possible confounders such as age and gender. Pearson's correlation coefficient was used to evaluate the strength of association between variables. The level $p < 0.05$ was considered as the cut-off value for significance.

RESULTS

Table 1 describes the socio-demographic characteristics of the surveyed children by mode of feeding. Of the studied 1278 infants, more than half of them (59.3%) were exclusively breastfed, followed by those partially breastfed (28.3%), and finally the formula fed (12.4%). The duration of exclusive breast feeding was with a mean and SD of 11.4 ± 6.7 months and the duration of partially breast feeding with bottle milk was with a mean and SD 9.2 ± 4.1 months and the difference was statistically significant ($p < 0.0010$). Half of the breastfed children were more likely to come from middle income household. There was a significant difference noted across these three categories in terms of their parental age group, smoking status of father, family income, and parental consanguinity. Table 2 gives prevalence of allergic diseases in studied infants according to mode of feeding. Asthma (15.6%), wheezing (12.7%), allergic rhinitis (22.6%) and eczema (19.4%) were less frequent in exclusively breastfed children, compared to infants with partial breastfeeding or formula fed. A significant difference was found across these three categories in all the allergic diseases, asthma, wheezing, allergic rhinitis eczema, and in terms of frequency of ear infections.

	Exclusive breast feeding	Partial breastfeeding	Formula milk	p value
Characteristic	N = 758(%)	N = 362(%)	N = 158(%)	
Age group (Years)				
<25	195(25.7)	82(22.7)	52(32.9)	
25-34	444(58.6)	214(59.1)	93(58.9)	0.020
>35	119(15.7)	661(85.2)	13(8.2)	
Mother's education				
Illiterate	145(19.1)	64(17.7)	32(20.3)	
Primary	300(39.6)	145(40.1)	72(45.6)	NS
Secondary	110(14.5)	62(17.1)	23(14.6)	
High School	88(11.6)	40(11)	11(7.0)	
University	115(15.2)	51(14.1)	20(12.7)	
Mother's Occupation				
Teacher	53(7.0)	25(6.9)	11(7.9)	
Police & Security Officer	10(1.3)	6(1.7)	2(1.3)	NS
Professional	146(19.3)	75(20.7)	26(16.5)	
House wife	549(72.4)	256(70.7)	119(75.3)	
Smoking Mother				
Yes	55(7.3)	14(3.9)	11(7.0)	
No	703(92.7)	348(96.1)	147(93.0)	NS
Smoking Father				
Yes	206(27.2)	121(33.4)	53(33.5)	
No	552(72.8.1)	241(66.6)	105(66.5)	0.05

Table 1: Socio-demographic characteristics of the studied children according to mode of feeding (N = 1278).

*: 1 US\$ = 3.64 Qatari Riyals.

NS = Not-significant.

• Suite pas suivante

Characteristic	Exclusive Breast-feeding N =758(%)	Partial Breast-feeding N =362(%)	Formula milk N =58(%)	p value
Socio-economic status (QR)				
Low , <10,000	172(22.7)	99(27.3)	30(19)	0.032
Medium 10,000-15,000	383(50.5)	174(48.1)	86(54.4)	
High >15,000	203(26.8)	89(24.6)	42(26.6)	
House type / condition				
Villa	208(27.4)	102(28.0)	33(20.9)	NS
Semi Villa	276(36.4)	83(22.9)	37(23.4)	
Traditional house	125(16.5)	54(14.9)	21(13.3)	
Apt. Flat	149(19.7)	123(34)	67(42.6)	
University	115(15.2)	51(14.1)	20(12.7)	
Gender of baby				
Male	359 (47.4)	189(52.2)	84(53.2)	
Female	399(52.6)	173(47.8)	74(46.8)	
Birth order of child				
1-2	355(46.8)	168(46.4)	85(53.8)	NS
3-4	287(37.9)	139(38.49)	53(33.5)	
5-8	116(15.3)	55(15.2)	20(12.7)	
Parents Consanguineous				
Yes	249(32.9)	131(36.2)	69(43.7)	NS
No	508(67.1)	231(63.8)	89(56.3)	

Table 1: Suite

Table 3 shows relationship between the mode of feeding and Allergic diseases according to maternal and paternal allergies. In infants with family history of maternal allergies, a significant difference was noted in eczema (P=0.007), and ear infection (P=0.0001) across the three categories; infants with exclusive breastfeeding, partial breastfeeding

and on formula feeding. On the contrary, in infants with family history of paternal atopy, there was a significant difference in any allergic disease(P=0.0001), asthma (P=0.0001 I, and allergic rhinitis (P=0.015).

Table 4 shows the multivariate logistic regression analysis of factors associated with mode of feeding. Mothers having first baby, mother with asthma and allergic rhinitis, and father with allergic rhinitis were considered as the main factors associated with the mode of feeding. Figure 1 illustrates the prevalence of allergic diseases in exclusively but prolonged (>6 months) breastfed children compared to the short-term fed «6months) children. The risk of allergic diseases in children, in particular eczema (18.6% vs. 13.4%¹, wheeze (10.7% vs. 8.4%) and ear infection (28.1% vs. 21.8%), were lower in children with prolonged breast feeding (>6months) than in those with short breast feeding duration «6months).

DISCUSSION

The present study findings shows that, when compared to partially breastfed or formula fed infants, exclusively breastfed infants developed less frequent allergic diseases, but not ear infection. This is the first epidemiologic study of the relationship between breastfeeding and the prevalence of allergic diseases in this part of the world. The current study supports published data from developed countries that breastfeeding protects against developing asthma and atopy in children (13-24). A multi-

Clinical variables	Exclusive breast feeding N = 758(%)	Partial breastfeeding N = 362(%)	Formula milk N = 158(%)	p-value
Asthma*	118 (15.6)	83 (22.9)	56 (35.4)	0.001
Wheeze	96 (12.7)	57 (15.7)	33 (20.9)	0.021
Allergic rhinitis	171 (22.6)	130 (35.9)	48 (30.4)	0.0001
Eczema	147 (19.4)	98 (27.1)	45 (28.5)	0.003
Ear infections	204 (26.9)	58 (17.3)	121 (33.4)	0.012

Table 2: Prevalence of allergic diseases in studied children according to mode of feeding.
*: physician-diagnosed asthma.

Allergic diseases	Maternal atopy			p value	Paternal atopy			p value
	Exclusive breast feeding	Partial breastfeeding	Formula milk		Exclusive breast feeding	Partial breastfeeding	Formula milk	
	N = 758 (%)	N = 362 (%)	N = 158(%)		N = 758 (%)	N = 362 (%)	N = 158(%)	
Any Allergic Disease	275 (36.2)	139 (38.4)	64 (40.5)	NS	224 (29.6)	131 (3.16)	63 (39.8)	0.0001
Asthma*	81 (10.7)	49 (13.5)	22 (13.9)	NS	64 (8.4)	92 (25.4)	33 (20.9)	0.0001
Wheezing	8(1.1)	8(2.2)	4(2.5)	NS	10(1.3)	6(1.7)	3(1.9)	NS
Allergic rhinitis	173 (22.8)	104 (28.7)	40 (25.3)	NS	136 (17.9)	92 (25.4)	33 (20.9)	0.015
Eczema	149 (19.7)	97 (26.8)	44 (27.8)	0.007	129 (17.0)	79 (21.8)	28 (17.7)	NS
Ear Infection	23 (3)	19 (5.2)	11 (6.9)	0.000	22 (2.9)	14 (3.9)	3(1.9)	NS

Table 3: Relationship between the mode of feeding and Allergic diseases according to maternal and paternal atopy. NS = Not-significant.
*: physician diagnosed-asthma.

Independent Variables	Odds Ratio	95% Confidence Interval	P value
Mothers having first baby	2.65	1.91-3.67	0.0001
Mother has asthma	2.41	1.78-3.25	<0.001
Mother has allergic rhinitis	2.29	1.68-3.14	0.0001
Allergy to pets	2.15	1.49-3.05	0.0001
Father has allergic rhinitis	2.01	1.10-3.73	0.018
Mother age < 25 years	1.45	1.01-2.09	0.040
Father smoker	1.37	1.05-1.78	0.018

Table 4: Multivariate logistic regression analysis factors associated with mode of feeding.

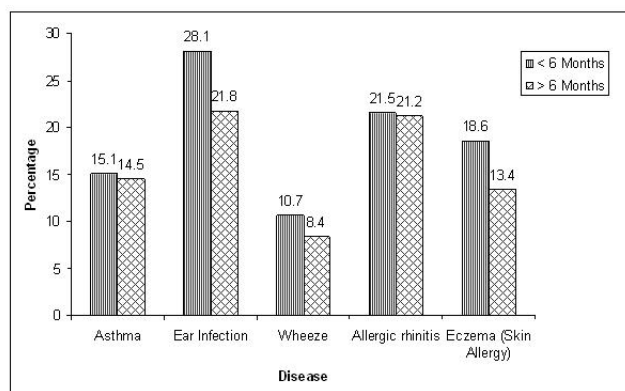


Figure 1: The prevalence of allergic diseases in exclusively breast fed children with short (<6moths) and prolonged breastfeeding duration.

center group (23) from northern Europe also conducted a review of the literature related to breastfeeding and atopic allergies and concluded that breastfeeding seems to protect individuals from atopic allergies. Australian researchers (27) investigated 2,195 children for 6 years to evaluate the effect of breastfeeding on asthma, allergy and obesity. They found that infants who were exclusively breast fed had a lower incidence of asthma and allergic diseases. Most interesting of all, every month of additional breastfeeding resulted in a 4% reduction in the risk of asthma. Also, a cross-sectional study conducted in south Africa (15) among 861 children reported that allergic diseases in general were significantly less frequent in those with prolonged breastfeeding (>6 months). Our study findings are in agreement with these two studies. Our study showed a significant difference in all allergic diseases across the three categories; exclusively breastfed, infants with partial breastfeeding and infants with formula milk.

In the present study, asthma was significantly less frequent in infants who were exclusively breastfed compared to infants with partial breastfeeding and formula fed. This is in line with two cohort studies done by Infante-Richard et al. (28), and Oddy et al. (26) showing a protective association between breastfeeding and asthma, but at variance with a population based study in Japan (29) showed that breastfeeding might be related to the higher prevalence of asthma during preadolescence.

Our data also shows that allergic rhinitis was significantly lower in exclusively breast fed infants compared to infants with partially breast feeding. However, we could not observe any difference in prevalence of allergic rhinitis with duration of breastfeeding. Recently, in a meta-analysis (24) by Bloch et al that reviewed all studies of breastfeeding and allergic rhinitis published between 1966 and 2000 concluded that exclusive breastfeeding during the first 3 months of life protects children against allergic rhinitis.

We found that wheezing was significantly lower in exclusively breastfed studied infants compared to infants with partial breast feeding and formula milk. Besides, wheezing was less in infants with prolonged breastfeeding (>6 months), compared to those with short-term breast feeding. This is similar to the results of an Italian study³⁰ that breastfeeding for more than 3 months was protective against the development of early wheezing, but was a risk factor for late onset wheezing.

Similar to other allergic diseases, our study reveals that eczema was significantly less prevalent in exclusively breastfed infants, compared to partial breast fed or formula fed and also is much lower in infants with prolonged breastfed (>6 months), compared to short-term fed. A cross sectional study conducted in

Japan (18) investigated the association between the feeding pattern and the prevalence of allergic disorders in Japanese school children (19). A clear positive relationship was observed between prolonged duration of breastfeeding and the prevalence of atopic eczema as found in our study subjects.

In a recent systematic review with meta-analysis of prospective studies, Gdalevich et al. (22) found a protective effect of breastfeeding on asthma and atopic eczema, especially among children with a family history of atopy. Our data indicates that in children with a maternal atopy there was no significant difference regarding asthma, allergic rhinitis or wheezing between the exclusively breastfed and partially breastfed infants. However, there was a difference in terms of eczema and ear infection. But the paternal atopy affected the relation negatively between breast feeding and allergic diseases like eczema, wheezing and ear infection. This depicts that a history of allergy in either parent might neutralize the protective effect of prolonged breastfeeding. This observation has been reported previously in a study done by Savilhati (31). Logistic regression revealed that mothers having first baby, mothers with asthma and allergic rhinitis, and father with allergic rhinitis were the significant main factors associated with breastfeeding. This indicates a strong interaction between the parental atopy(genetic factors) and protective breastfeeding in the development of allergic diseases in children.

CONCLUSIONS

The current study indicated that exclusive breastfeeding has protective effect against asthma and allergic diseases. It opens an avenue for developing countries with limited health resources to encourage exclusive breastfeeding for first 6 months to reduce the risk of asthma and other allergic diseases. The main associated factors with breastfeeding for allergic diseases were mothers with first baby, maternal history of asthma and allergic rhinitis, and paternal history of allergic rhinitis. There is a need for prospective community based studies to evaluate the relation of duration of breast feeding and allergic diseases.

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