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Original Article

Breastfeeding Practice and Its Association with Respiratory Symptoms and Atopic Disease in 1–3-Year-Old Children in the City of Riyadh, Central Saudi Arabia

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Abstract

Background: Saudi Arabia has a declining rate of breastfeeding and increasing levels of childhood asthma and atopic disease. In highly economically developed countries, breastfeeding of children at high risk of atopic disease reduces the likelihood of atopic dermatitis, wheezing associated with respiratory infections, and possibly asthma. This study investigated the prevalence of breastfeeding and its association with wheezing/asthma and atopic disease in 1–3-year-old children in Riyadh, Saudi Arabia.

Subjects and Methods: A cross-sectional study of children attending routine "well-baby" clinics in three Saudi State Hospitals in Riyadh. An interviewer administered a questionnaire to collect data on sociodemographics, breastfeeding, wheezing symptoms, asthma, and atopic disease.

Results: In total, 622 children 1–3 years old were recruited. Of these, 75% of children were ever breastfed, and 36% of children were fully breastfed, with 20% of children being fully breastfed for ≥3 months. Increasing duration of full breastfeeding was associated with a reduced likelihood of maternal reporting of her child having "ever wheezed," "wheezed' in the last 12 months," and "ever having asthma," with adjusted odds ratio for full breastfeeding ≥12 months versus never breastfed of 0.51 (95% confidence interval 0.29–0.90), 0.48 (0.26–0.88), and 0.46 (0.22–0.94), respectively. No associations were demonstrable between full or ever breastfeeding and atopic dermatitis/eczema, irrespective of family history of atopic disease.

Conclusions: Although breastfeeding does not protect children from developing eczema in Riyadh, full breastfeeding is associated with reduced childhood wheezing and possibly asthma. Further efforts should be made to promote breastfeeding in Saudi Arabia.

Introduction

IN THE LAST DECADE the exclusive breastfeeding of infants in the Middle East and North Africa has decreased by 8% (from 33% to 25%),[1] whereas in East/South Asia, there has been at least a 3% increase (from 27% to 32% and 41 to 44%, respectively)[1] in exclusive breastfeeding rates. The Middle East/North Africa region has gone from the second highest global rate of exclusively breastfed infants in 1996 to one of the lowest in 2006.[1] In Saudi Arabia the duration and exclusivity of breastfeeding have decreased over the last two decades[2] (from 41% in 1987[3] to 27% in 2004[4] for exclusive breastfeeding). The health consequences of changing breastfeeding practices in Saudi Arabia are unknown, but the Saudi Ministry of Health has publicly highlighted the need for the health services to e ucate and encourage mothers about the benefits of breastfeeding.[5]

Extrapolation of data from highly economically developed countries suggests that a decline in the prevalence of breastfeeding in Saudi Arabia should result in an increase in childhood atopic dermatitis, wheeze, and possibly asthma, particularly in children with parents having atopic dermatitis. A clinical review by the American Academy of Pediatrics (AAP) in 2008[6] concluded that for infants at high risk of atopic disease, exclusive breastfeeding (with or without hydrolyzed infant formula) for ≥4 months reduces the risk of atopic dermatitis when compared with breastfeeding with supplements of standard cow milk–based formulas. Further conclusions were that breastfeeding for >3–4 months did not confer any additional benefit and that breastfeeding generally is unlikely to reduce the risk of atopic dermatitis in low-risk infants. The AAP statement also concluded that although breastfeeding in younger children (<4 years) seems to reduce the incidence of wheezing episodes that are often associated

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with respiratory infections, it was not possible to conclude that breastfeeding reduced the risk of asthma in children in the long term (>6 years). A more recent review of the literature concluded that although exclusive breastfeeding for ≥3 months reduces the risk of atopic dermatitis, at least during infancy, there is no clear reduction in the risk of asthma.[7]

Asthma and atopic diseases have markedly increased in prevalence in highly economically developed countries over the last 40 years with consequent impacts on healthcare systems.[8,9] In Saudi Arabia, asthma and atopic diseases have also become more widespread in recent decades, with current rates of around 15–20% of children.[10,11]

The current study took place in the city of Riyadh, the capital of Saudi Arabia. With around 5 million residents it has the largest city population of the country.[12] The city is predominantly an urban and affluent region[11]; however, Saudi Arabia as a whole is 82% urban.[13] The aim of this study was to characterize the prevalence of breastfeeding in Riyadh and to investigate whether the reported beneficial associations between breastfeeding and reduced risk of atopic dermatitis, wheezing, and possibly asthma reported in highly economically developed countries are present in Saudi Arabia, a society that differs from highly economically developed countries in many respects (e.g., smoking prevalence, diet, and genetic susceptibility). Although several studies have reported on the prevalence of breastfeeding in Saudi Arabia, none appears to have investigated possible associations with childhood asthma/wheeze/atopic outcomes. It is hoped that the results of this study could contribute to the shaping of public health policy and ultimately improve the well-being of children in Saudi Arabia.

Subjects and Methods

A cross-sectional study was conducted in the pediatric outpatient clinics of three government hospitals (King Fahad National Guard, King Khalid, and King Fahad Medical City) in Riyadh, between April and May 2009. Mothers of 1–3-year-old children attending routine "well-baby" outpatient clinics of the three hospitals were asked to participate. In Saudi Arabia it is routine clinical practice for all children to attend annual "well-baby" clinics in the hospital where they were born, irrespective of gestational age, neonatal complications, etc. An interviewer administered a questionnaire to the mother to obtain information about her 1–3-year-old child attending the clinic. All mothers attending the clinics were approached and asked to participate. There were no exclusion criteria.

Data collection was through an interviewer-administered questionnaire, which was translated into Arabic by computer translation software and then corrected by two Saudis fluent in both Arabic and English. The questionnaire was then translated back into English by another bilingual person. A pilot study using the translated questionnaire was administered to a small group of Saudi mothers to test language comprehension and wording. It was then modified accordingly. The questionnaire collected data on maternal sociodemographic characteristics (age, education, household income, smoking history), family history of asthma/atopic disease in relation to the child (maternal, paternal, sibling), the breastfeeding history of the child (prevalence, duration, cessation), and reasons for not commencing breastfeeding. The International Study of Asthma and Allergies in Children (ISAAC)[14] core questions pertinent to wheeze (wheezing or whistling sound in the chest), asthma, and eczema were used to collect data on wheeze/asthma and atopic outcomes. If mothers asked for clarification of questions, the ISAAC-recommended approach was followed, and if this failed to clarify issues the question was left blank as recommended. The questions on breastfeeding were adapted from those used by the 2005 United Kingdom Infant Feeding Survey[15] conducted every 5 years. Informed written consent was granted by the mothers before each interview was conducted. Approval was given for the protocol of the study by the Internal Review Boards of the three hospitals.

Analyses were performed using SPSS version 19.0 software (SPSS Inc., Chicago, IL). The primary outcome variables of interest were maternal reports of wheezing symptoms, asthma, and atopic dermatitis/eczema in the study children.

The explanatory variable of interest was breastfeeding history, which was classified as the duration of full breastfeeding (age when infant formula or other fluids, except water, were introduced) or breastfeeding (that is, age when breastfeeding was stopped) and categorized into never, 0–3 months, 3–6 months, 6–12 months, and >12 months.

Univariate associations among sociodemographics, breastfeeding, center, and wheezing/atopic outcomes were explored using χ^2 tests, t tests, and analysis of variance where appropriate. Associations between wheeze and atopic outcomes were expressed as Mantel–Haenszel odds ratios (ORs) with 95% confidence intervals (CIs). Multivariate analysis was carried out using logistic regression with adjustment for the covariates of maternal age, child's sex, child's age, parental atopic disease, maternal smoking, and hospital center. These covariates were chosen because of obvious sources of variation (sex, age, center), because of recognized associations (parental atopic disease, maternal smoking), or because of associations ($p<0.2$) between the variables and either breastfeeding and/or respiratory/atopic outcomes on univariate analysis.

Results

During a 7-week study period, 730 consecutive mothers were approached, with 721 (99%) mothers agreeing to participate. Complete datasets were available for 622 (86%) mother–child pairs; 99 (14%) datasets were not included because they were incomplete (mothers being called for appointment or having to leave because of time pressure). These 99 women with incomplete data did not differ from the 622 providing complete data with regard to socioeconomic status, age, or choice of infant feed (breastfed, formula, or mixed-feed).

Table 1 outlines the demographic details of the study population. The median age of the mothers was 29 years (interquartile range, 26–34 years), with no significant differences among the three centers. The majority (94.9%) of mothers were Saudi nationals, and this differed among the centers. Among-center differences were also noted for the socioeconomic parameters of educational status and monthly income. The number of children in the family also differed among centers.

Table 2 outlines the reported prevalence and duration of the various types of breastfeeding reported by the mothers. In

TABLE 1. CHARACTERISTICS OF RECRUITED MOTHERS

	All (n=622)	*King Fahd Medical City* (n=345)	*National Guard Hospital* (n=153)	*King Khalid University Hospital* (n=124)	p *for trend (between centers)*
Age (years)					
Median	29.0	29.0	30.0	29.5	0.172
IQR	26–34	25.3–33.0	27.0–35.5	25–35.0	
Range	18–55	19–45	18–55	20–46	
Highest educational status					0.003
Illiterate/elem[a]	97 (15.6%)	52 (15.1%)	34 (22.2%)	11 (8.9%)	
Middle school	105 (16.9%)	58 (16.8%)	19 (12.4%)	28 (22.6%)	
High school	222 (35.7%)	128 (37.1%)	42 (27.5%)	52 (41.9%)	
University	198 (31.8%)	107 (31.0%)	58 (37.9%)	33 (26.6%)	
Monthly income (Saudi riyals)[b]					0.001
<1,000	64 (10.3%)	29 (8.4%)	28 (18.3%)	7 (5.6%)	
1,001–5,000	211 (33.9%)	123 (35.6%)	47 (30.7%)	41 (33.1%)	
5,001–10,000	249 (40.0%)	146 (42.3%)	57 (37.3%)	46 (37.1%)	
>10,000	98 (15.8%)	47 (13.6%)	21 (13.7%)	30 (24.2%)	
Current smokers	8 (1.3%)	3 (0.9%)	4 (2.6%)	1 (0.8%)	0.302
Total number of children					0.001
Median	3.0	2.0	3.0	3.0	
IQR	2–4	2–4	2–4	2–5	
Range	1–15	1–11	1–15	1–11	
Saudi National [*n* (%)]	590 (94.9%)	335 (97.1%)	140 (91.5%)	115 (92.7%)	0.016

[a]Illiterate/elementary education.
[b]According to the exchange rate in June 2011, 1,000 Saudi riyals is approximately £167 sterling.
IQR, interquartile range.

total, 74.6% of mothers reported that they had breastfed their infant at some point, and 298 (48.0%) reported that they breastfed for ≥3 months, either full breastfeeding or some breastfeeding. Of the mothers, 340 (54.7%) reported that their infant had received breastmilk plus formula, 210 (33.8%) for ≥3 months, whereas 221 (35.5%) mothers reported that they had fully breastfed their infant at some point, with 128 (20.5%) reporting that they had full breastfed their infant for ≥3 months, and 113 (51.1%) of those that had fully breastfed at some point reported that they had continued to breastfeed but in combination with formula feed (i.e., breastmilk plus formula). There appeared to be no differences among hospital centers in breastfeeding rates.

No associations were found between breastfeeding pattern and maternal age or number of children. Table 3 outlines the associations between socioeconomic status and breastfeeding patterns. Full breastfeeding of infants for ≥3 months was strongly associated with decreasing maternal educational status (p for trend = 0.006). The reasons why mothers did not start breastfeeding were obtained from 144 of the 158 mothers who never breastfed their infant: the reasons stated included "child health problem" (34.7%), "breastmilk provided insufficient food" (19.4%), and "maternal health problem" (15.3%). The reasons for stopping breastfeeding included "breastmilk provided insufficient food" (28.5%), "pressures of work" (13.4%), "child health problem" (10.5%), and "maternal health problem" (9.7%).

Table 4 provides details relevant to the study children. Median age was 20 months (interquartile range, 15–24 months), 47.4% of the study children were girls, and 66.1% of

TABLE 2. DURATION AND PATTERNS OF BREASTFEEDING FOR STUDY CHILDREN REPORTED BY MOTHERS

	n (%)		
Duration	*Breastfeeding*	*Breastfeeding plus complementary foods*[a]	*Full breastfeeding*
Never	158 (25.3%)	282 (45.2%)	401 (64.5%)
<3 months	166 (26.7%)	130 (21.0%)	93 (15.0%)
≥3 months	298 (48.0%)	210 (33.8%)	128 (20.5%)

[a]One hundred thirteen mothers who fully breastfed continued to breastfeed with formula.

TABLE 3. BREASTFEEDING AND ASSOCIATED SOCIODEMOGRAPHIC CHARACTERISTICS

Characteristic	*Any breastfeeding* [n (%)]	p for trend	*Full breastfeeding for ≥3–4 months* [n (%)]	p *for trend*
Education		0.762		0.006
Illiterate	24 (75.0%)		9 (28.1%)	
Elementary	50 (76.9%)		18 (27.7%)	
Middle school	80 (76.2%)		27 (25.7%)	
High school	161 (72.5%)		43 (19.4%)	
University	149 (75.3%)		31 (15.7%)	
Income (Saudi riyals)		0.054		0.184
<1,000	47 (73.4%)		11 (17.2%)	
1,001–5,000	148 (70.1%)		41 (19.4%)	
5,001–10,000	190 (76.3%)		51 (20.5%)	
10,000	79 (80.6%)		25 (25.5%)	

Table 4. Children's Characteristics

Child's characteristic	n *(%)*
Age (months)	
Median	20
IQR	15–24
Range	12–36
Sex (female)	295 (47.4%)
Atopy	
Maternal	204 (32.8%)
Paternal	184 (29.6%)
Sibling	233 (37.5%)
Any family member	411 (66.1%)
Outcome	
Ever wheeze	297 (47.7%)
Wheeze in last 12 months	231 (37.1%)
Sleep disturbed wheeze last year	182 (29.2%)
Wheeze due to exercise (last 12 months)	94 (15.1%)
Ever asthma	162 (26.0%)
Ever eczema	105 (16.9%)

IQR, interquartile range.

the children had a parent and/or sibling with a history of asthma or atopic disease. In total, 47.7% of mothers reported that their child had ever wheezed, and 37.1% reported that their child had wheezed in the last year. In total, 26.0% of mothers reported that the study child had a diagnosis of asthma, and 16.9% reported a diagnosis of eczema. There were the expected associations between family history of asthma/atopic disease and increased reporting of wheeze, asthma, and eczema outcomes in the study children. Maternal reporting of "ever wheeze" in the study child was more common in children with a history of eczema (OR 1.58, 95% CI 1.03–2.41, $p=0.035$), and asthma was more common in boys (OR 1.49, 95% CI 1.04–2.15, $p=0.031$). Eczema was more common in children living in Riyadh compared with those living out of Riyadh (18.9% vs. 9.6%, $p=0.01$) and in children from higher-income households (23.5% for >10,000 Saudi riyals vs. 12.5% for <1,000 Saudi riyals, p for trend = 0.037). No association was found between maternal reports of wheezing/asthma and eczema in their children and maternal smoking during pregnancy or smoking in the house by members of the household at the time of the study (3.2% and 31.2%, respectively).

Multivariate analyses (Table 5) demonstrated the combination of breastfeeding and formula feeding, particularly if for ≥12 months, was associated with a reduced likelihood of a maternal report of her child wheezing in the previous 12 months at 1–3 years of age ($p=0.012$). Breastfeeding of any kind was not associated with maternally reported eczema in the children 1–3 years old, whereas a history of any breastfeeding was associated with a reduced likelihood of reported "wheeze in last 12 months" (OR 0.61, 95% CI 0.42–0.89). Full breastfeeding for more than 12 months was also associated with a reduced likelihood of a maternal report of asthma (OR 0.46, 95% CI 0.22–0.94). A history of full breastfeeding was associated with a reduced likelihood of "ever wheeze," and "wheeze in the last 12 months" was associated with evidence that more prolonged full breastfeeding was more beneficial. Replacing monthly income with maternal educational level did not substantially modify the reported associations. Restricting the analyses to children with a family history of atopic disease did not reveal any associations between any form of breastfeeding and eczema.

Discussion

This study demonstrates that 75% of women in Riyadh, Saudi Arabia, had breastfed their child at some point; however, although 36% had fully breastfed at some point, only 20% had fully breastfed for >3 months. Breastfeeding was not associated with reduced maternal reporting of eczema in their children 1–3 years old, even in children at high familial risk of

Table 5. Multivariant Analysis of Breastfeeding's Association with Asthma/Atopic Outcomes

	Ever wheeze		*Wheeze in last 12 months*		*Asthma*		*Eczema*	
Type of feeding, duration	*OR (95% CI)*	p *for trend*	*OR (95% CI)*	p *for trend*	*OR (95% CI)*	p *for trend*	OR (95% CI)	p *for trend*
Any breastfeeding								
0	1		1		1		1	
Any	0.72 (0.50–1.04)	0.083	0.61 (0.42–0.89)	0.010	0.87 (0.57–1.32)	0.507	1.15 (0.69–1.90)	0.593
Breastfeeding with complementary foods								
0	1		1		1		1	
0–3 months	0.94 (0.61–1.44)		1.13 (0.73–1.74)		1.11 (0.68–1.80)		1.13 (0.64–2.02)	
3–6 months	0.77 (0.49–1.23)	0.06	0.89 (0.55–1.43)	0.012	1.11 (0.66–1.88)	0.481	1.39 (0.77–2.54)	0.303
6–12 months	0.56 (0.29–1.11)		0.67 (0.33–1.35)		0.61 (0.27–1.40)		2.11 (0.99–4.50)	
>12 months	0.71 (0.41–1.23)		0.45 (0.24–0.84)		0.86 (0.46–1.64)		0.99 (0.47–2.14)	
Full breastfeeding								
0	1		1		1		1	
0–3 months	0.97 (0.61–1.53)		0.81 (0.50–1.30)		0.99 (0.59–1.70)		1.12 (0.61–2.06)	
3–6 months	1.16 (0.58–2.30)	0.009	0.72 (0.35–1.49)	0.001	1.16 (0.53–2.54)	0.076	1.38 (0.59–3.22)	0.761
6–12 months	0.40 (0.17–0.95)		0.24 (0.08–0.72)		0.91 (0.37–2.25)		1.44 (0.55–3.75)	
>12 months	0.51 (0.29–0.90)		0.48 (0.26–0.88)		0.46 (0.22–0.94)		0.68 (0.31–1.58)	

All analyses were adjusted for maternal age, child's sex, child's age, parental atopic disease, maternal smoking, and hospital center.
CI, confidence interval; OR, odds ratio.

developing atopic disease. However, full breastfeeding, particularly for 6–12 months or more, was associated with a reduced likelihood of mothers reporting that their child had ever wheezed or wheezed in the last 12 months. The rate of mothers reporting asthma was lower among those breastfed for more than 12 months.

The rate of ever breastfeeding a child in Saudi Arabia since 1987 has been reported to range from 82% to 95%, with any breastfeeding at 6 months declining from 65% in 1987[3] to 50% in 2008[16] and the prevalence of exclusive breastfeeding falling from 41% in 1987 to 27% in 2004.[4] In the current study, although fewer women (75%) reported ever breastfeeding, the duration of full breastfeeding appeared to be greater than reported previously in Saudi Arabia, with 36% reporting ever exclusively breastfeeding and 37% reporting breastfeeding for at least 6 months. The current study's finding that the preferred method of feeding was breastfeeding supplemented with milk formula is consistent with previous studies in Saudi Arabia.[4,13,17,18] The results of the current study (i.e., demonstrating increased duration of breastfeeding in the three Riyadh hospitals studied) might be explained by increased efforts of these hospitals to actively promote breastfeeding (personal communications from the hospitals' breastfeeding committees). The finding in the current study that only 75% of women had breastfed their child may reflect a continued misconception in Saudi Arabia that breastmilk is an insufficient form of infant feeding.[5,13,19–23] As in previous studies we were able to demonstrate an association between increasing educational status (and income) and reduced breastfeeding.[5,24–26] The likely higher educational level of the women in Riyadh, which has the lowest illiteracy rate of the Saudi regions,[27] may have contributed to the low rate of breastfeeding in our study, similar to findings of previous studies in Saudi Arabia.[17,22,28] A previous study in Riyadh has reported whether a woman was working to be more important that educational status in determining breastfeeding[16]; however, a limitation of our study was that we did not collect data on occupational status.

We believe this to be the first study to investigate the association between breastfeeding and childhood asthma/wheezing and atopic outcomes in Saudi Arabia. However, two previous studies have been conducted in Abha, a city in the southern region of Saudi Arabia that differs from Riyadh in several aspects. First, it is located 7,200 feet above sea level in a fertile mountainous area. Second, it is subjected to rain year-round, and its weather is cooler than that of Riyadh. The weather in Riyadh is very hot in summer and cold in winter, the city is more prone to dust storms, and rain is seen mainly in the winter season. The Abha study of 100 infants ≤2 years old reported breastfeeding to be associated with a reduced risk of respiratory tract infections,[29] whereas another study of 166 infants ≤6 months old reported that exclusive breastfeeding was associated with a reduced likelihood of hospitalization with bronchiolitis.[30] In the current study it is most likely that the majority of the wheezing symptoms reported by the mothers of the children 1–3 years old were a consequence of viral respiratory tract infection. The associations between full breastfeeding and reduced likelihood of early childhood wheeze reported by the present study are consistent with previous local studies and prospective studies in highly economically developed countries.[31–33]

The current study supports the conclusions of the AAP[6] that exclusive breastfeeding reduces wheezing episodes in younger children (<4 years of age); however, in the current study this association was present for full breastfeeding and not limited to children at high familial risk of asthma/atopic disease. Although the AAP was not able to definitively conclude that exclusive breastfeeding protects young infants from developing asthma, the current study demonstrated an association between full breastfeeding for ≥12 months and a reduced likelihood of children developing asthma by the age of 3 years. This finding is consistent with studies in New Zealand,[32,33] but because of the high incidence of viral-associated wheezing symptoms in this age group one needs to be very cautious in the current study about a maternal diagnosis of asthma in a child 1–3 years old in the absence of clinical confirmation. The mechanism by which breastfeeding protects against the development of wheezing and eczema is an area of active research. Breastmilk contains a wide range of immunomodulatory constituents such as maternal immune cells, immunoglobulins, antioxidants, fatty acids, lysozyme, oligosaccharides, and cytokines that have been implicated in early life immune maturation and susceptibility to respiratory tract infection.[34] The current study was unable to demonstrate any association between breastfeeding and eczema, irrespective of family history of atopic disease, a finding not consistent with the conclusions of the AAP. Although study limitations may have contributed to our inability to demonstrate an association between breastfeeding and eczema, it is possible that such an association does not exist in Saudi Arabia, a country with a markedly different environment, lifestyle (e.g., diet), and social habits. As an illustration, although 31.2% of children lived in a household that included someone who smoked in the home, only 3.2% of mothers smoked during pregnancy. Further studies need to be conducted in Saudi Arabia to confirm or refute our findings.

In addition to those topics discussed above, further strengths and limitations need to be considered. Although this was a hospital-based study, the sample population is likely to be representative of the general population because it is routine clinical practice in Saudi Arabia for all children to attend annual "well-baby" clinics in the hospital where they were born, irrespective of their neonatal history. The study sample thus included several premature infants. Unfortunately, we did not collect these data; however, it is unlikely that this will have substantially affected the reported associations because the incidence of premature births in Saudi Arabia is about 4%[35] and 4.6–5.3% in Riyadh (personal communication from neonatal intensive care unit database managers). Moreover, in our study neonatal child health problems were only reported for 8% of the children. However, we cannot exclude the possibility that these children attending hospital "well-baby" clinics differed from those attending primary care clinics because the breastfeeding in the current study differed somewhat from that reported previously in Riyadh in a predominantly primary care study that did not address the association between breastfeeding and asthma/wheeze/atopic outcomes.[23] Although the sample population was likely to be representative of the general population sampled with a low refusal rate from consecutively approached mothers, the cross-sectional nature of the study and the reliance on mothers' responses do introduce the possibility of recall bias. The questionnaire used to collect breastfeeding data was validated

(albeit not in Saudi Arabia); however, it should be noted that the type of formula feed used by the mothers was not ascertained. The ISAAC questionnaire is widely used to collect wheezing and atopic outcome data although not validated in this age group. Although we were able to adjust for factors known to be associated with asthma, wheeze, and eczema, as in any cross-sectional study it is not possible to exclude the possibility that the reported associations reflect residual confounding.

Conclusions

This study supports evidence from highly economically developed countries that breastfeeding protects against wheezing symptoms and possibly asthma in Saudi Arabian children; however, no protective effect was demonstrated against eczema, which contradicts findings from studies in highly economically developed countries. Further research is required to clarify the association between breastfeeding and eczema in Saudi Arabia. The results suggest that continued efforts should be made to educate mothers about the benefits of breastfeeding and to actively promote breastfeeding to all mothers in the Kingdom of Saudi Arabia. However, the current study adds to the growing body of evidence that in Saudi Arabia breastfeeding is less likely to be taken up by mothers of higher educational and financial standing, suggesting somewhat paradoxically that special effort be made to identify these women in order to promote breastfeeding.

Disclosure Statement

No competing financial interests exist.

References

1. UNICEF. Breastfeeding Overview. 2006. www.childinfo.org/breastfeeding_overview.html (accessed May 2009).
2. Kilani RA. Routine feeding practices in a university hospital in Riyadh: Are they Baby Friendly? *Ann Saudi Med* 1999;19:267.
3. Al-Mazrou YY, Aziz KM, Khalil M. Breastfeeding and weaning practices in Saudi Arabia. *J Trop Pediatr* 1994;40:267–271.
4. Ogbeide DO, Siddiqui S, Al Khalifa IM, et al. Breastfeeding in a Saudi Arabian community. Profile of parents and influencing factors. *Saudi Med J* 2004;25:580–584.
5. Al-Jassir MS, El-Bashir BM, Moizuddin SK, et al. Infant feeding in Saudi Arabia: Mothers' attitudes and practices. *East Medit Health J* 2006;12:6–13.
6. Greer FR, Sicherer SH, Burks AW. Effects of early nutritional interventions on the development of atopic disease in infants and children: The role of maternal dietary restriction, breastfeeding, timing of introduction of complementary foods, and hydrolysed formulas. *Pediatrics* 2008;121:183–191.
7. Kramer MS. Breast feeding and allergy: The evidence. *Ann Nutr Metab* 2011;59(Suppl 1):20–26.
8. Burney PGJ. Epidemiologic trends. In: Barnes PJ, Grunstein MM, Leff AR, et al., eds. *Asthma.* Lippincott-Raven Publishers, Philadelphia, 1997, pp. 35–47.
9. Devenny A, Wassall H, Ninan T, et al. Respiratory symptoms and atopy in children in Aberdeen: Questionnaire studies of a defined school population repeated over 35 years. *BMJ* 2004;329:489–490.
10. Hijazi N, Abdalkhail B, Seaton A. Asthma and respiratory symptoms in urban and rural Saudi Arabia. *Eur Respir J* 1998;12:41–44.
11. Al Frayh AR, Shakoor Z, Gad El Rab MO, et al. Increased prevalence of asthma in Saudi Arabia. *Ann Allergy Asthma Immunol* 2001;86:292–296.
12. Riyadh Population. http://en.wikipedia.org/wiki/Riyadh (accessed September 2011).
13. Saudi Arabia Population. https://www.cia.gov/library/publications/the-world-factbook/geos/sa.html (accessed September 2011).
14. ISAAC Questionnaire. http://isaac.auckland.ac.nz/resources/tools.php?menu=tools1#quest (accessed March 2009).
15. NHS Infant Feeding Survey. www.ic.nhs.uk/pubs/breastfeed200516 (accessed March 2009).
16. Al-Hreashy FA, Tamim HM, Al-Baz N, et al. Patterns of breastfeeding practice during the first 6 months of life in Saudi Arabia. *Saudi Med J* 2008;29:427–431.
17. Alwelaie YA, Alsuhaibani EA, Al-Harthy AM, et al. Breastfeeding knowledge and attitude among Saudi women in central Saudi Arabia. *Saudi Med J* 2010;31:193–198.
18. Khattab MS. Cross-sectional study of a child health care programme at one family practice centre in Saudi Arabia. *East Medit Health J* 2000;6:246–259.
19. Al-Nahedh NN, Morley DC. Infant feeding practices and the decline of breastfeeding in Saudi Arabia. *Nutr Health* 1994;10:27–31.
20. Madani KA, Al-Nowaisser AA, Khashoggi RH. Breastfeeding patterns in Saudi Arabia. *Ecol Food Nutr* 1994;31:239–245.
21. Al-Ayed IH, Qureshi MI. Breastfeeding practices in urban Riyadh. *J Trop Pediatr* 1998;44:113–117.
22. Fida NM, Al-Aama JY. Pattern of infant feeding at a university hospital in western Saudi Arabia. *Saudi Med J* 2003;24:725–729.
23. Amin T, Hablas H, Al Qader AA. Determinants of initiation and exclusivity of breastfeeding in al Hassa, Saudi Arabia. *Breastfeed Med* 2011;6:59–68.
24. Al-Frayh AS. Current trends in infant feeding in Saudi society. *J Obstet Gynaecol (Lahore)* 1989;10(Suppl 1):S21–S22.
25. Al-Nasser AN, Bamgboye EA, Alburno MK. A retrospective study of factors affecting breastfeeding practices in a rural community of Saudi Arabia. *East Afr Med J* 1991;68:174–180.
26. Al-Othman AM, Saeed AA, Bani IA, et al. Mothers' practices during pregnancy, lactation and care of their children in Riyadh, Saudi Arabia. *Saudi Med J* 2002;23:909–914.
27. Riyadh Literacy Rate. http://en.wikipedia.org/wiki/Education_in_Saudi_Arabia (accessed September 2011).
28. Al-Shehri SN, Farag MK, Baldo MH, et al. Overview on breastfeeding patterns in Saudi Arabia. *J Trop Paediatr* 1995;41:38–44.
29. Abdulmoneim I, Al-Ghamdi SA. Relationship between breast-feeding duration and acute respiratory infections in infants. *Saudi Med J* 2001;22:347–350.
30. Al-Shehri MA, Sadeq A, Quli K. Bronchiolitis in Abah, southwest Saudi Arabia: Viral etiology and predictors for hospital admission. *West Afr J Med* 2005;24:299–304.
31. Elliott L, Henderson J, Northstone K, et al. Prospective study of breast-feeding in relation to wheeze, atopy and bronchial responsiveness in the Avon Longitudinal Study of Parents and Children (ALSPAC). *J Allergy Clin Immunol* 2008;122:49–54.

32. Silvers KM, Frampton CM, Wickens K, et al. Breast feeding protects against adverse respiratory outcomes at 15 months of age. *Matern Child Nutr* 2009;5:243–250.
33. Silvers KM, Frampton CM, Wickens K, et al. Breastfeeding protects against current asthma up to 6 years of age. *J Pediatr* 2012;160:991–996.e1.
34. Rautava S, Walker WA. Academy of Breastfeeding Medicine Founder's Lecture 2008: Breastfeeding—An extrauterine link between mother and child. *Breastfeed Med* 2009;4:3–10.
35. Al-Qahtani DA, Imtiaz ML, Al-Dusari SN, et al. Frequency of visits for health care by low-birth-weight and preterm Saudi infants in the first year of life. *East Medit Health J* 2005;11:732–744.

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