

Breastfeeding at 6 Months and Effects on Infections

J K Chye, C T Lim

ABSTRACT

Aims: To examine the pattern of and the influence of some socio-demographic factors on infant milk feedings, and the protective role of breastfeeding against infections.

Methods: Mothers who breastfed their infants (exclusively or partially) at 6 weeks postpartum, and who had singleton pregnancies and healthy infants at birth, were interviewed when their infants had reached 6 months of age.

Results: Of the 234 mothers studied, only 31 (13%) mothers were practising exclusive breastfeeding (EBF) and 133 (57%) mothers were using exclusive infant formula feeding (EIF). Solid and semi-solid foods were introduced between 4 to 6 months of life in 89% of the infants. On logistic regression analysis, mothers who were in paid employment [OR 0.25, 95% CI 0.15, 0.42] and not breast feeding at 6 weeks [OR 0.32, 95% CI 0.19, 0.54] had decreased odds of EBF. Antenatal plans to breastfeed, breast-feeding difficulties, ethnicity, level of parental education, parental ages, fathers' income, primigravida status and infants' gender were not significant co-variables. In comparison, EIF was more likely in mothers who worked, practised mixed feedings at 6 weeks and of Chinese descent. There were no significant differences in the rates of upper respiratory tract infections (URTI) or diarrhoeal illnesses between the infants who were or were not being breast-fed.

Conclusions: Most mothers were unable to breastfeed their infants exclusively in the recommended first 4 to 6 months of life. Complementary changes outside the hospital and maternity services are essential in improving breastfeeding rates. Breastfeeding does not appear to confer significant protection to either URTI or gastrointestinal tract infections.

Keywords: breastfeeding, ethnicity, infant, infection, Malaysia

INTRODUCTION

Breast-feeding, in particular exclusive breast-feeding (EBF), is recommended for infants in the first 4 to 6 months of life^(1,2). The promotion of breastfeeding in Malaysia was given a renewed impetus in recent years through the WHO/UNICEF Baby Friendly Hospital Initiative⁽³⁾. Despite the many resultant changes in policies and practices aimed at improving breastfeeding at the University Hospital, Kuala

Lumpur (UHKL), the rates of EBF have remained poor. A survey done previously, found that of the 500 mothers who delivered at this urban tertiary referral hospital at 6 weeks post-partum, only 124 (25%) mothers were practising EBF and another 244 (49%) were supplementing breastfeeding with infant milk formulae (mixed feeding)⁽⁴⁾. The predictors for failure at 6 weeks were predominantly socio-demographic factors, rather than perinatal events, and these factors included maternal paid employment, breast-feeding difficulties, no antenatal plans to breast-feed, young mothers (≤ 27 years), of Chinese descent, and male infants⁽⁴⁾.

One main advantage of breastfeeding has been the protective effect against infections in infants, notably, on the respiratory and gastrointestinal tracts⁽⁵⁻⁹⁾. However, reductions in mortality and morbidity for these illnesses are reportedly more substantial in the less developed countries⁽¹⁰⁻¹³⁾ than amongst the more affluent societies⁽¹⁴⁻¹⁷⁾. In a rapidly industrialising country such as Malaysia, data on the protective role of breastfeeding against these diseases is forthcoming.

This follow-up study aimed to determine: a) the outcomes in milk feeding, and the influence of some socio-demographic factors on exclusive breastfeeding (EBF) and exclusive infant formula feeding (EIF) amongst 6-month-old infants who were breastfed at 6 weeks postpartum, and b) the protective effects of breastfeeding on respiratory tract infections and diarrhoeal illnesses in these infants.

METHODS

In our previous study, we had randomly selected at the UHKL's 6-week postpartum follow-up clinics, mothers who had delivered healthy singleton infants (with no major congenital malformations, no admissions to the Neonatal Intensive Care Unit, birth weights ≥ 2 kg and gestational ages ≥ 35 weeks)⁽⁴⁾. For this study, those who were still breast-feeding their infants at 6 weeks, were contacted via telephones. Those who agreed to participate in this study were recruited. Telephone interviews were conducted between February and April 1996, when the infants had reached 6 months of age. Information on the socio-demographic data, current modes of milk feeding, age at introduction of infant formulae and solid foods, reasons for

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ceasing breastfeeding, and history of respiratory tract or diarrhoeal illnesses were obtained.

In this study, EBF denotes breast milk as the sole milk drink for the infants; EIF denotes artificial milk only, and mixed feeding referred to a combination of both types of milk. These definitions were adopted as solid and semi-solid foods, and non-milk liquids are commonly introduced to infants at 3 – 4 months of age in our population. Upper respiratory tract infection (URTI) is defined by symptoms of coryza, coughs and pharyngitis, and lower respiratory tract infection (LRTI) by respiratory infection requiring hospitalisation or diagnosed by a doctor. Diarrhoeal illness refers to an increase in stool frequency with associated decrease in stool consistency. Diagnoses made by medical practitioners were accepted as they were.

Statistical analysis

Data were analysed with the Statistical Package for the Social Sciences (Windows version, Release 6.1, SPSS Inc., Chicago, III)⁽¹⁸⁾. The Chi-square statistics and Student's t-test were used for univariate analyses. Multivariate logistic regression analysis using the backward stepwise process (likelihood ratio) were performed to assess the independent risk factors for the outcomes measured. For these purposes, all the variables of interest were grouped into two categories, except for the three races. For continuous variables, the median values and specific values of interest were selected for such dual groupings. The statistical significance level was taken at $p < 0.05$.

RESULTS

Socio-demographic and perinatal profile

Two-hundred and thirty-four (64%) of the 368 mothers who were still breastfeeding their infants at 6 weeks were contacted; the remaining 134 mothers had neither home nor office telephones, or had moved or changed jobs, and therefore, were not contactable. There were no significant differences in the rates of EBF [75 (32%) versus 49 (37%)] or mixed feeding [159 (68%) versus 85 (63%)] at 6 weeks ($p = 0.380$) between the mothers who were and were not interviewed. However, mothers in this study were more likely to be working [173 (74%) versus 72 (53%), OR 1.32, 95% CI 1.02, 1.67, $p = 0.032$], had > 9 years of formal education [183 (78%) vs 74 (56%), OR 1.41, 95% CI 1.09, 1.82, $p = 0.010$] and whose husbands' monthly income were > RM 900 [132 (56%) versus 47 (35%), OR 1.35, 95% CI 1.06, 1.69, $p = 0.012$] compared to those not interviewed, after adjusting for other socio-demographic and perinatal co-variables.

The racial composition of the mothers in this study included 170 (73%) Malay, 42 (18%) Indian and 22 (9%) Chinese mothers. The mean (SD) of the maternal and paternal ages were 28.7 (5.3) years

and 32.0 (5.6) years respectively. Seventy-eight percent of both parents had > 9 years of formal education. The average (SD) paternal monthly income was RM1,211 (850) and median of RM950. The types of jobs the fathers engaged in were clerical [54 (23%)], trades [49 (21%)], unskilled labour [47 (20%)], business and sales activities [37 (16%)], professional [28 (12%)] and security forces [19 (8%)]. For the 175 (74%) mothers who worked, their jobs included clerical [75 (43%)], professional [45 (26%)], unskilled labour [32 (18%)], and other miscellaneous jobs [23 (13%)]. Five mothers who were not in paid employment during their pregnancies, had started work after the third post-partum month; one mother had ceased her employment shortly after recommencing work.

The mean (SD) gestational age and birthweights of the 234 infants were 39.3 (1.2) weeks and 3.08 (0.43) kg respectively. There were similar number of male [112 (48%)] and female infants. One-hundred and twenty-nine (55%) mothers were primiparae, and 159 (68%) mothers had antenatal plans to breastfeed.

Infant feeding

At 6 months, only 31 (13%) mothers were still practising EBF, and 133 (57%) mothers had resorted to EIF (Table I). Of the 75 mothers who were giving EBF at 6 weeks, 25 (33%) had continued to EBF, 30 (40%) had switched to mixed feeding and 20 (27%) had resorted to EIF. Bottle feeding was introduced by the second, third and fourth months in 25 (50%), 12 (24%) and 8 (15%) of the 50 mothers who had stopped practising EBF respectively. For the remaining 159 mothers who were giving mixed feeding at 6 weeks, 6 (4%) had reverted to EBF, 38 (24%) had continued with mixed feeding and 115 (72%) had changed to EIF.

As for the 133 mothers who had stopped breastfeeding, 47 (35%), 38 (29%), 25 (19%), 12 (9%), and 11 (8%) had correspondingly done so by the second, third, fourth, fifth and sixth months. The reasons for stopping breastfeeding were maternal paid employment [52 (39%)], having little or no breast milk [51 (38%)], infant refusal [13 (10%)], maternal and infant illnesses [12 (9%)] and infants being cared for by their grandparents who were

Table I – Modes of milk feeding at 6th week and 2nd, 4th & 6th months of life for the 234 infants (percentages are in parentheses)

	6th week	2nd month	4th month	6th month
EBF	75 (32)	56 (24)	42 (18)	31 (13)
Mixed feeding	159 (68)	131 (56)	110 (47)	70 (30)
EIF	0 (0)	47 (20)	110 (47)	133 (57)

EBF = exclusive breast-feeding

EIF = exclusive infant formula feeding

Mixed feeding = combination of breast- and infant-formula feeding

living apart from the parents [5 (4%)]. The latter was due to mothers having to return to paid employment.

Fifty-six (24%) of this cohort of mothers had breastfeeding difficulties in the first 6 weeks; the problems encountered included insufficient milk supply [44 (79%)], nipple and breast problems [7 (13%)], and maternal tiredness and infant refusal [5 (8%)].

Malay mothers had the highest rate of EBF, and Chinese, the lowest (Fig 1). These racial differences, however, were not statistically significant. On

univariate analysis, mothers who worked practised mixed feeding at 6 weeks and had breastfeeding difficulties within the first 6 post-natal weeks, were associated with decreased likelihood of EBF, whereas having antenatal plans to breastfeed and parents with ≤ 9 years of schooling were associated with increased odds of EBF (Table II). However, on the logistic regression model, only maternal paid employment [OR 0.25, 95% CI 0.15, 0.42, $p < 0.001$] and not EBF at 6 weeks [OR 0.32, 95% CI 0.19, 0.54, $p < 0.001$] were independent risk factors for decreased odds of EBF.

In comparison, mothers who worked, gave mixed feeding at 6 weeks, had breastfeeding difficulties, had no antenatal plans to breastfeed, of primigravida status and of Chinese descent, were factors associated with increased odds of EIF on univariate analysis (Table III).

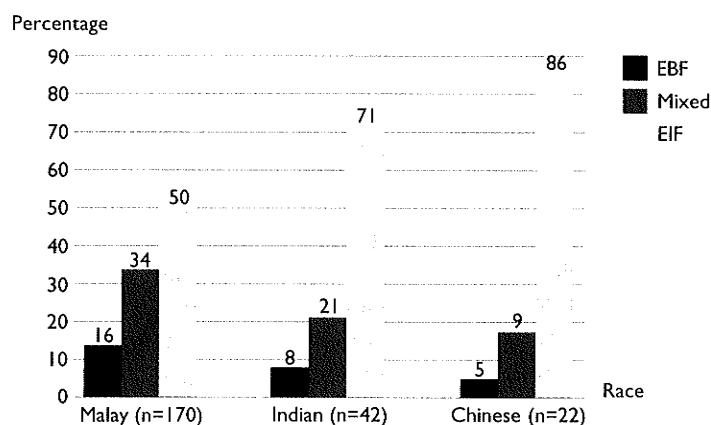
On logistic regression analysis, only mothers in paid employment [OR 1.49, 95% CI 1.02, 2.17, $p=0.038$], practised mixed feeding at 6 weeks [OR 2.08, 95% CI 1.49, 2.94, $p = 0.013$] and of Chinese descent (compared to Malays [OR 2.03, 95% CI 1.16, 3.56, $p = 0.003$]) were predictive of increased likelihood of EIF.

Furthermore, multiparae mothers who had breastfed their previous children for more than 6 months were more likely to breastfeed their infants at 6 months than the mothers who had not [12 (75%) vs 33 (37%), OR 5.09, 95% CI 1.52, 17.08, $p = 0.005$].

Eighty-nine percent of the infants were started on semi-solid and solid food between 4 to 6 months of age (median and mode at 4 months). The range of food included rice porridge (plain or with added vegetables and meats), commercial cereals, biscuits and fruit juices. There was no significant difference in the mean ages (SD) when solid food was introduced between those who were given EBF at 6 months and those who were not [4.5 (0.7) vs 4.3 (1.1) months, $p = 0.31$].

Infections

Upper respiratory tract infections (URTI) occurred in 161 (69%) infants; 84 (52%), 48 (30%) and 29 (18%) of these infants had one, two and ≥ 3 episodes of URTI respectively. Ninety-seven (60%) infants had their first episode of URTI at ≤ 4 months. On univariate analysis, there were no significant differences in the rates of URTI between the infants who were EBF versus non-EBF [19 (61%) vs 142 (79%), OR 0.68, 95% CI 0.31, 1.49, $p = 0.33$] or EIF versus non-EIF [93 (70%) vs 68 (67%), OR 1.07, 95% CI 0.61, 1.86, $p = 0.82$] at 6 months. Similarly, univariate and logistic regression analyses had not revealed any significant differences in the rates of URTI at 6 months for either EBF (versus non-EBF) or EIF (versus non-EIF) at the second, fourth or sixth months of life. Instead, the risk of contracting URTI in the first 6 months of life was significantly increased if the infant was not the first-born [OR 2.23, 95% CI 2.08, 2.38, $p < 0.001$], whose mother was in paid employment [OR 1.71,



EBF = exclusive breastfeeding, EIF = exclusive infant formula feeding, Mixed = supplementing breastfeeding with infant formula. The differences in the rates for EIF (but not EBF) among the three races are statistically significant, $p < 0.001$ (* 2 14.4, 2 df). Numbers above the histograms indicate the percentages of the 3 types of milk for each ethnic group.

Fig 1 – Mode of infant milk feeding among the three races at 6 months

Table II – Socio-demographic data of mothers who EBF at 6 months as compared to those who do not EBF (univariate analysis)

	EBF (%) (n=31)	non-EBF (%) (n=203)	OR (95% CI)	P values
Mother working	6 (19)	167 (83)	0.05 (0.02, 0.13)	0.001
Mixed feeding at 6 weeks	6 (19)	152 (75)	0.08 (0.03, 0.20)	<0.001
BF difficulties at 6 weeks	2 (7)	53 (26)	0.19 (0.04, 0.84)	0.016
Antenatal plans to BF	30 (97)	128 (63)	17.3 (2.32, 130)	<0.001
Maternal education*	13 (42)	38 (19)	3.11 (1.40, 6.91)	0.004
Paternal education*	11 (36)	40 (20)	2.22 (1.00, 5.02)	0.049
Race				
Malay	27 (16)	143 (84)		
Indian	3 (7)	39 (93)		0.142
Chinese	1 (9)	21 (91)		
Primigravida	15 (48)	114 (56)	0.72 (0.34, 1.54)	0.401
Paternal age (≤ 31 years)	11 (36)	99 (49)	0.57 (0.26, 1.26)	0.160
Maternal age (≤ 27 years)	14 (45)	99 (49)	0.86 (0.40, 1.83)	0.690
Father's wage**	15 (48)	87 (43)	1.24 (0.58, 2.64)	0.578
Male gender	141 (45)	98 (49)	0.87 (0.41, 1.87)	0.728

OR = Odds Ratio and 95% CI = 95% Confidence Interval

EBF = exclusive breastfeeding and BF = breastfeeding

* formal schooling of ≤ 9 years

** monthly income of \leq RM 900

Table III – Socio-demographic data of mothers who EIF at 6 months as compared to those who do not EIF (univariate analysis)

	EIF* (n=134)	non-EIF* (n=100)	OR (95% CI)	P values
Mother working	109 (81)	64 (65)	2.38 (1.31, 4.34)	0.004
Mixed feedings at 6 weeks	114 (73)	45 (44)	7.14 (3.85, 12.5)	<0.001
BF difficulties at 6 weeks	44 (80)	11 (11)	3.91 (1.90, 8.06)	<0.001
No antenatal plans to BF	19 (49)	23 (22)	2.27 (1.26, 4.17)	0.005
Primigravida	82 (64)	47 (48)	1.74 (1.03, 2.95)	0.037
Race				
Malay	85 (50)	85 (50)		
Indian	30 (71)	12 (29)		
Chinese	19 (86)	3 (14)		<0.001

* Numbers in parentheses are percentages. BF = breastfeeding
EIF = exclusive infant formula feeding, EBF = exclusive breastfeeding
OR = Odds Ratio and 95% CI = 95% Confidence Interval

Table IV – URTI and the significant covariates in the 78 infants receiving either EBF for 6 months or EIF from 6 weeks (multivariate logistic regression)

	URTIC* (n=54)	No URTIC* (n=24)	OR (95% CI)**	P values
Not first-born	24 (44)	5 (21)	2.41 (1.26, 4.63)	0.008
Mother not working	18 (33)	15 (63)	0.41 (0.23, 0.74)	0.003

URTIC - Upper respiratory tract infections
OR = adjusted Odds Ratio and 95% CI = 95% Confidence Interval
* Numbers in parentheses are percentages
** Calculated using a stepwise logistic regression model

95% CI 1.45, 2.38, $p = 0.001$] and the father was younger (≤ 31 years) [OR 1.82, 95% CI 1.26, 2.62, $p = 0.002$]. Other factors such as history of diarrhoeal illness, mother's age, parental educational levels, father's income, race and gender of the infant were not significant confounders.

In contrast to URTI, only 32 (14%) infants had diarrhoeal illnesses. Twenty-nine (91%) infants had only one episode of diarrhoea and 23 (72%) infants had their first episode of diarrhoea beyond 4 months of age. The risks of diarrhoea were not significantly related to either the modes of milk feeding or to any of the above socio-demographic factors.

With the progression of EBF to mixed feeding, EIF had occurred at various periods, we further compared a subgroup of 31 infants who were breastfed exclusively for 6 months with another subgroup of 47 infants who were given EIF from 2 months. The prevalence of URTI and diarrhoeal illnesses amongst these 78 infants were 54 (69%) and 7 (9%) respectively, and these were similar to the overall rates. The proportions of infants with URTI [19 (61%) vs 35 (75%), $p = 0.22$] or diarrhoeal illnesses [3 (10%) vs 4 (9%), $p = 0.86$] in the EBF and EIF groups were not significantly different. The increased risk of acquiring an URTI was again associated with having young siblings at home and mothers in paid

employment (Table IV), but not to the two modes of milk feeding or other socio-demographic variables. As before, diarrhoeal illnesses were not associated with any types of milk feeds or socio-demographic factors.

Except for 3 infants with LRTI, none of the other 231 infants required hospitalisation for these illnesses. One of the 3 infants with LRTI was given EBF for 4 months and thence EIF, and the other 2 infants had received mixed feeding from 6 weeks till 3 and 6 months of age before switching to EIF. No mortality was observed in our cohort of study subjects.

DISCUSSIONS

The overall rate of EBF at 6 months was a mere 31 (13%) as compared to 75 (32%) mothers at 6 weeks in our study. This decline is largely predicted by maternal paid employment and not giving EBF at 6 weeks.

Maternal paid employment is a well-known association with shorter duration of breastfeeding, and greater use of artificial milk formula and bottle feeding⁽¹⁹⁻²¹⁾. Maternal tiredness, inconvenience, shift-work, insufficient milk and infant refusal are some of the secondary reasons cited by our working mothers. The precise mechanisms by which such employment interferes with breastfeeding requires careful evaluations, in order that interventions such as the provision of proper facilities for breastfeeding activities at the workplace⁽²²⁾, could be implemented to help minimise its adverse effects on breastfeeding.

Not being breastfed exclusively at 6 weeks as a predictor for stopping EBF and using EIF at 6 months is hardly surprising, as the progression from breastfeeding to non-human milk feeding is anticipated, and that mothers who had previously breastfed for longer than 6 months were more likely to do so again for their subsequent children. However, it is possible for mothers who had practised mixed feeding initially to revert to EBF subsequently as was practised by mothers in our study. Unless relactation, which is not practised in our setting is actively encouraged and promoted^(23,24), it is highly unlikely that mothers who had given up breastfeeding would resume EBF.

The trend for the lowest rate of EBF and highest reliance on EIF amongst the Chinese mothers in Malaysia, as compared to the two other major ethnic groups (Malays and Indians) have remain unchanged for the past 20 years^(25,26). The reasons for this phenomenon are unknown.

Solid and semi-solid foods were started appropriately between 4 and 6 months by most mothers. The introduction of these foods did not appear to be an important contributing factor to the rapid decline in breastfeeding, as 85 (64%) of the mothers who had stopped breastfeeding and 37 (73%) of those who had stopped EBF had done so prior to the fourth month. The impact of giving other liquid drinks other than breast milk is unclear.

Our results indicate that URTI, unlike LRTI, is prevalent in the first 6 months of life, and that EBF is neither protective of nor is EIF a risk factor for contracting a respiratory illness. Instead, exposure to older siblings, and having mothers who work and young fathers were factors which increased significantly the risk of acquiring URTI. The occurrence of intercurrent URTI amongst family members, especially siblings, was frequently reported, but due to inadequate documentation, this aspect could not be analysed further. As we were only primarily interested in the effects of milk feeding on infections, other confounding factors such as parental smoking⁽²⁸⁾ and child day care attendance⁽²⁹⁾ were not explored. Maternal smoking, in our experience, is rare. It is possible that the working mothers in our study had left their infants with caretakers who had other young children in their care, and therefore, increased the risks of these infections. Having young fathers as a risk factor for acquiring URTI is interesting, but needs further studies for clarifications. In developed countries, breastfeeding seems to protect only against the more severe forms of respiratory tract infections (namely, LRTI or needing hospitalisation)^(14,15,27). Our study appears to support that contention as LRTI was uncommon amongst our infants; all of the 234 infants had been breastfed for at least 6 weeks, with 124 (53%) infants beyond 4 months old.

We did not observe any significant differences in the rates of diarrhoeal illnesses between the EBF- and non-EBF infants, and to other socio-demographic factors. This may be due to a combination of a low disease prevalence, a probable good standard of hygiene practised, and the availability of a high quality piped-water and sewerage system. Our finding is comparable to reports from more affluent countries^(16,30). The non-milk solid foods are probable important contributors to these illnesses, as most of the diarrhoeal episodes had occurred at the time when these foods were introduced.

Finally, as the patterns of breastfeeding at 6 weeks amongst the 134 mothers not interviewed were similar to our 234 studied mothers, one would expect that our selection bias for working mothers in this study may predispose to poorer rates of breastfeeding and higher rates of URTI observed. However, given that the majority [72 (53%)] of the non-interviewed mothers were also in paid employment, the influence may not be significant. Also, based on the mothers in this study, differences in the levels of maternal education and paternal income between these 2 groups of mothers could possibly have little or no effect on the overall rates of breastfeeding and infections.

In conclusion, few mothers were able to breast-feed their infants exclusively for the first 4 – 6 months. The risk factors for failure to breastfeed and resorting to infant formula identified in this study provide important strategies to improve the rates of breastfeeding. Whilst hospital and

maternity services play important roles in initiating mothers to breastfeed, supportive changes outside these services are essential to help maintain and prolong the duration of breastfeeding. In our current urban setting, breastfeeding does not appear to confer any significant protective advantages to either upper respiratory tract or gastrointestinal tract infections.

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