Determinants of breastfeeding practices among mothers in Malawi: a population-based survey

Roselyn Chipojola[a], Gabrielle T. Lee[b], Hsiao-Yean Chiu[a], Pi-Chen Chang[a] and Shu-Yu Kuo[a,*]

[a]School of Nursing, College of Nursing, Taipei Medical University, 250 Wuxing Street, Taipei 11031, TAIWAN; [b]Applied Psychology, Faculty of Education, Western University, 1137 Western Road London, Ontario, Canada, N6G 1G7

*Corresponding author: Tel: 886-2-2736-1661 ext. 6308; Fax: 886-2-2377-2842; E-mail: sykuo@tmu.edu.tw

Background: High rates of early initiation and exclusive breastfeeding have been reported in Malawi, yet the underlying factors are unknown. Our objective is to examine the determinants of breastfeeding practices for mothers of infants less than 24 months old in Malawi.

Methods: A cross-sectional study was conducted using nationally representative data from the 2010 Malawi Demographic and Health Survey. Multivariate logistic regression analysis was used.

Results: Of 7282 women, 95.4% initiated breastfeeding within 1 hour after birth; thereafter 71.3% of women practiced exclusive breastfeeding, 6.1% predominantly breastfed, and 1.9% chose bottle feeding exclusively. The odds of early initiation were higher among women with frequent antenatal care visits and multiparous mothers. Similarly, frequent antenatal care visits and hospital delivery were positive determinants for exclusive breastfeeding. Infants at 6 months of age were more likely to predominantly breastfeed than they were at 1 month. The odds of bottle feeding were higher among women who were educated, who delivered at a hospital.

Conclusions: Optimal breastfeeding practices are highly prevalent in Malawi. Health care practice emphasizing frequent antenatal care visits that provide breastfeeding education and breastfeeding support in hospital care after childbirth are important for sustaining breastfeeding.

Keywords: early breastfeeding, breastfeeding determinants, Malawi, exclusive breastfeeding, bottle feeding, breast milk, antenatal visits, sustainable breastfeeding practices, prenatal breastfeeding education

Introduction

Numerous physical and mental health benefits of breastfeeding exist for both mother and infant. Breastfeeding not only helps mothers in postpartum involution and returning to pre-pregnancy weight but it also lowers the risk of breast or ovarian cancer, and cardiovascular disease.[1] Further, breast milk provides essential nutritional factors which offer immunity from short and long term illnesses and it is generally regarded as the most cost-effective and simplest intervention to safeguard the lives of babies at risk.[2] This is particularly true in countries with high infant morbidity and mortality, such as Malawi.[3]

Breastfeeding interventions in Malawi were launched in 1993 based on the Baby-Friendly Hospital Initiative (BFHI) standards by adherence to the Ten steps to successful breastfeeding measures. These included prenatal breastfeeding education offered at each antenatal visit and postpartum breastfeeding care by trained health staffs in the hospital setting.[4] As a result, the rate of exclusive breastfeeding for infants less than 6 months from 1993 to 2004 increased notably from 3% to 53%.[5] Unfortunately, Malawi BFHI became languished due to losses in external funding since 2004. A meta-analysis of breastfeeding studies of 2010–2015, suggested that the rate of early initiation and exclusive breastfeeding for infants less than 6 months increased in Africa and Malawi was ranked the highest in 2010.[6] Besides losses of external funding, key factors explaining the high rates of breastfeeding in Malawi remained unclear. Understanding factors that promote breastfeeding with BFHI is crucial for establishing programs to improve breastfeeding practices.

Early initiation and exclusive breastfeeding are recognized as important breastfeeding practices globally. WHO recommends

that mothers initiate breastfeeding within 1 hour after birth, continue exclusive breastfeeding coverage of 90% until 6 months, and then follow with safe adequate nutritional complementary foods up the age of 2 years or beyond.[7] Recent evidence indicates that mothers who initiate breastfeeding early are more likely to continue exclusive breastfeeding up to 6 months,[8] while bottle feeding has a negative effect on the duration of exclusive breastfeeding.[9] Although breastfeeding is commonly practiced in Malawi, limited research studies have investigated breastfeeding practices among the general population in Malawi,[10,11] with existing Malawian studies being conducted in the central and southern areas,[11–13] thus indicating that nationwide information is lacking. Two studies had a small number of participants,[12,14] the first focused only on mothers with HIV,[15] and the second was conducted more than a decade ago and just focused on two breastfeeding practices i.e., initiation and duration of breastfeeding.[16] Therefore, it is imperative to analyze data using a nationally representative sample in 2010 to explore the underlying determinants of a relatively high rate of breastfeeding practices that occurred in Malawi.

Several determinants are associated with mothers' engagement in breastfeeding.[17] Currently, research has shown mixed results in some determinants. For instance, when mothers' level of education is used as a predictor, studies have shown that its effect on bottle feeding range from null,[15] positive,[16] to negative.[16] Similarly, some researchers suggest that mothers in rural areas are more predisposed to exclusive breastfeeding,[18] while others suggest contrary findings.[19] Different cultural contexts and study demographics such as low literacy level in Malawian women may also have contributed to the differences in results.[20] However, whether similar factors influence breastfeeding practices in African populations need further investigations.

The present study explored determinants of breastfeeding practices in a nationwide cohort of mothers and children adopted from the 2010 Malawi Demographic and Health Survey (MDHS), which achieved a relatively high rate of breastfeeding after launching the BFHI Ten steps from 1993 to 2004 in Malawi. The specific aims of this study were to (a) investigate the prevalence of breastfeeding practices among mothers with children aged 0~23 months and (b) to identify determinants of early initiation of breastfeeding, exclusive breastfeeding, predominant breastfeeding, and bottle feeding by Malawian mothers.

Materials and methods

A cross-sectional study was conducted using data from the 2010 Malawi Demographic and Health Survey (MDHS). The 2010 MDHS was implemented by the Malawi National Statistical Office (NSO) in collaboration with the United States Agency for International Development (USAID) in 2010.[21] Briefly, a stratified two-stage random sampling was used with 158 urban and 691 rural areas serving as primary sampling units, and households were used in the second sampling stage. Detailed information on breastfeeding was collected from mothers (aged 15~49 years), who were permanent residents or visitors in the households the night before the survey, using a structured questionnaire. The response rate was 98%.[21]

Measures

Breastfeeding indicators

In the present study, we adopted the WHO and UNICEF definitions of breastfeeding indicators as follows[22,23]:

- **Early initiation of breastfeeding:** children born in the last 24 months who were put to the breast within 1 hour of birth.
- **Exclusive breastfeeding:** infants aged 0~5 months of age who are exclusively fed breast milk.
- **Predominant breastfeeding:** infants aged 0~5 months who receive breast milk as the predominant source of nourishment and the child is also fed certain liquids (e.g., water, water-based drinks, fruit juice, and oral rehydration solution, drops, or syrup).
- **Bottle feeding:** infants aged 0~23 months who receive any liquids or semi-solid food from a bottle with a nipple.
- **Optimal breastfeeding:** infants who receive early initiation of breastfeeding and exclusive breastfeeding until 6 months.

Study variables

Factors that were shown to be associated with breastfeeding or breastfeeding interventions in prior studies were included as follows.[17,24] Socio-demographic factors included the child's age (0~1, 2~3, 4~5, 6~11, and 12~23 months), mother's age (15~24, 25~34, and 35~49 years), place of residence (rural or urban), as well as mother's and spouse's education (no education, primary school, secondary school, or higher). The mother's working status was classified as 'not working' or 'working', and mother's marital status was recoded as never married, divorced, married, or cohabiting. Obstetric factors that were associated with breastfeeding interventions in prior studies included antenatal visits (categorized into none, 1~3, or ≥4 visits), birth order (1st, 2nd-4th, and>4th), delivery place (home or hospital), and delivery mode consisted of normal vaginal or caesarean deliveries.

The dependent variables were coded as dichotomous. Early initiation of breastfeeding was given a code of 0 for 'not practicing' and 1 for 'practicing' early initiation. Exclusive breastfeeding was coded 0 for 'non-exclusive breastfeeding' and 1 for 'exclusive breastfeeding'. Predominant breastfeeding was assigned a code of 0 for 'not practicing' and 1 for 'practicing' predominant breastfeeding. Bottle feeding was coded 0 for 'not bottle feeding' and 1 for 'bottle feeding'.

Data analysis

Data analysis was performed using the STATA version 13 (Stata Corp., College Station, TX, USA). 'Svy' commands were adapted to allow adjustment for a cluster sampling design, sampling weights, and the calculation of standard errors. Confidence intervals (CIs) around prevalence estimates were calculated using the Taylor series linearization method. Univariate and multivariate logistic regression analyses were used to estimate odds ratios (ORs) at 95% CIs. Both Variance Inflation Factor of value <10 and Tolerance index value> 0.1 was used to examine multicollinearity between variables.[25] Both unadjusted and

adjusted ORs were calculated to determine which determinants were significantly associated with breastfeeding practices. The *p-value* set to <0.05 was used to determine the statistical significance of study variables.

Ethical considerations

This study was approved by the Taipei Medical University Institutional Review Board. Permission to use and analyze the dataset was obtained from the MEASURE DHS project. The data used for the present analysis already contained an anonymous linked protocol developed by the MEASURE DHS before its use. This protocol does not display personal identifiable information of participants.[21]

Results

Prevalence of breastfeeding indicators

About 95.4% (95% CI: 94.5, 96.4) of mothers with children aged 0~23 months initiated breast milk feeding within the first hour of delivery. Among mothers of infants aged 0~5 months, 71.3% (95% CI: 70.7, 72.1) practiced exclusive breastfeeding, 6.1% (95% CI: 6.1, 6.2) predominant breastfeeding, and 1.9% (95% CI: 1.9, 1.9) bottle feeding. The prevalence of exclusive breastfeeding was highest (92.9%) among mothers with infants aged 0~1 month, and decreased to 40.4% at 4~5 months (Table 1).

Determinants of early initiation of breastfeeding

Nearly half of the mothers had children aged 12~23 months (49.8%), and 19.1% of the children were first born. The majority of mothers were aged 25~34 years (42.9%). Approximately 88.0% of the mothers were married or cohabiting, and 67.7% of

mothers had primary school education. Most spouses had primary school education (58.9%). Approximately 73.7% of the mothers were working. 95.7% and 77.8% of the mothers had a normal vaginal delivery and delivered in the hospital, respectively. About half of the mothers had attended 1~3 antenatal visits (54.7%), and most of the mothers were residing in rural areas (85.3%) (Table 2).

Univariate analyses revealed that being married, frequent antenatal visits, multiparity, and caesarean delivery were significantly associated with early initiation of breastfeeding. In multivariate models, adjusted OR of frequent antenatal visits (1~3 visits =3.7, 95% CI: 1.9, 7.3; *p*<0.001; OR≥ 4 visits =3.4, 95% CI: 1.8, 6.3; *p*<0.001), higher birth order (OR=1.9, 95% CI: 1.3, 2.9; *p*<0.001), and caesarean section (OR=0.4, 95% CI: 0.3, 0.7; *p*<0.001) were significantly associated with early initiation of breastfeeding (Table 2).

Determinants of exclusive breastfeeding

The crude ORs of the child's age, frequent antenatal care visits, place of delivery and mother's working status were significantly associated with exclusive breastfeeding. After adjusting for all of the variables in Table 3, the child's age (OR for 2~3 months =0.3, 95% CI: 0.2, 0.5; *p*<0.001; OR for 4~5 months =0.04, 95% CI: 0.03, 0.08; *p*<0.001), delivery at a hospital (OR=1.7, 95% CI: 1.1, 2.5; *p*=0.01), and frequent antenatal care visits (OR for 1~3 visits =2.7, 95% CI: 1.0, 7.2; *p*=0.04; OR for ≥4 visits =3.4, 95% CI: 1.3, 9.1; *p*=0.02) remained significant (Table 3).

Determinants of predominant breastfeeding

Mothers with older infants had higher odds of predominant breastfeeding than mothers with younger infants (OR for 2~3 months =2.2, 95% CI: 1.0, 4.5; *p*=0.04; OR for 4~5 months =3.5,

Table 1. Proportion of breastfeeding indicators among mothers with children aged 0~23 months (*N*=7282)

Indicator	Size of subsample N (weighted)	*n* (weighted)	%	(95% CI)
Early initiation (0~23months)	**7282**	**6949**	**95.4**	**(94.5, 96.4)**
0~11 months	3647	3492	95.8	(94.8, 96.7)
12~23 months	3635	3457	95.2	(94.2, 96.1)
Exclusive BF (0~5 months)	**1656**	**1181**	**71.3**	**(70.7, 72.1)**
0~1 month	465	432	92.9	(92.0, 93.9)
2~3 months	649	530	81.7	(81.0, 82.7)
4~5 months	542	219	40.4	(40.1, 41.0)
Predominant BF (0~5 months)	**1656**	**101**	**6.1**	**(6.1, 6.2)**
0~1 month	465	13	2.8	(2.8, 2.9)
2~3 months	649	39	6.0	(5.9, 6.1)
4~5 months	542	50	9.2	(9.1, 9.3)
Bottle feeding (0~23 months)	**7282**	**279**	**3.8**	**(3.8, 3.8)**
0~5 months	1656	31	1.9	(1.9, 1.9)
6~11 months	1991	74	3.7	(3.7, 3.8)
12~23 months	3635	174	4.8	(4.8, 4.9)

BF, Breastfeeding; CI, confidence interval.

Table 2. Determinants of early initiation of breastfeeding and bottle feeding among mothers with children aged 0~23 months (*N*=7282)

Variable	%	Early initiation of breastfeeding		%	Bottle feeding	
		OR (95%CI)[a]	aOR (95% CI)[b]		OR (95%CI)[a]	aOR (95% CI)[b]
Sociodemographic variable						
Child's age (months)						
0~1	6.4	1.0	1.0	2.2	1.0	1.0
2~3	8.8	1.1 (0.6, 1.8)	0.7 (0.3, 1.3)	3.2	1.1 (0.4, 3.0)	1.0 (0.2, 4.2)
4~5	7.5	1.7 (0.9, 3.1)	1.2 (0.6, 2.5)	5.4	2.0 (0.8, 5.2)	1.9 (0.5, 6.9)
6~11	27.6	1.3 (0.9, 2.1)	1.1 (0.6, 1.9)	26.5	2.8 (1.2, 6.2)*	2.5 (0.8, 8.0)
12~23	49.8	1.2 (0.8, 1.8)	0.8 (0.5, 1.5)	62.7	3.6 (1.6, 8.0)*	3.5 (1.1, 10.8)*
Mother's age (years)						
15~24	41.5	1.0	1.0	39.1	1.0	1.0
25~34	42.9	1.2 (0.9–1.5)	1.0 (0.7, 1.4)	49.5	1.2 (0.9, 1.6)	1.3 (0.8, 2.0)
35~49	15.6	1.2 (0.9–1.7)	1.3 (0.7, 2.2)	11.5	0.7 (0.4, 1.1)	1.2 (0.6, 2.6)
Mother's marital status						
Never married/divorced	12.0	1.0	1.0	16.1	1.0	1.0
Married/cohabiting	88.0	1.4 (1.1–1.9)*	1.1 (0.7, 1.6)	83.9	0.8 (0.6, 1.1)	0.8 (0.4, 1.3)
Mother's education						
No education	16.1	1.0	1.0	6.1	1.0	1.0
Primary school	67.7	1.1 (0.8–1.5)	1.2 (0.8, 1.8)	46.2	1.5 (0.9, 2.4)	1.5 (0.8, 3.1)
≥ Secondary school	16.2	1.2 (0.8–1.8)	1.2 (0.6, 2.4)	47.7	5.8 (3.5, 9.7)***	3.4 (1.6, 7.1)***
Spouse's education						
No education	13.7	1.0	1.0	14.0	1.0	1.0
Primary school	58.9	1.2 (0.9–1.6)	0.9 (0.6, 1.4)	33.0	0.5 (0.4, 0.8)**	0.6 (0.3, 1.0)
≥ Secondary school	27.4	1.2 (0.8–1.7)	0.9 (0.5, 1.5)	53.0	1.6 (1.1, 2.3)*	0.9 (0.5, 1.6)
Mother's working status						
Not working	26.3	1.0	1.0	23.9	1.0	1.0
Working	73.7	1.0 (0.8–1.3)	0.9 (0.7, 1.3)	76.1	1.2 (0.9, 1.6)	1.4 (1.1, 2.0)*
Mother's place of residence						
Urban	14.7	1.0	1.0	34.8	1.0	1.0
Rural	85.3	0.8 (0.5, 1.2)	0.7 (0.4, 1.2)	65.2	0.3 (0.2, 0.4)**	0.8 (0.5, 1.3)
Obstetric variable						
Antenatal visits						
None	2.3	1.0	1.0	2.9	1.0	1.0
1~3 visits	54.7	3.9 (2.5, 6.3)***	3.7 (1.9, 7.3)***	49.6	0.5 (0.2, 0.9)*	0.5 (0.2, 1.1)
≥ 4 visits	43.0	3.4 (2.1, 5.5)***	3.4 (1.8, 6.3)***	47.5	0.6 (0.3, 1.2)	0.5 (0.2, 1.2)
Child's birth order						
1st	19.1	1.0	1.0	28.0	1.0	1.0
2nd~4th	51.7	1.9 (1.4, 2.8)***	1.9 (1.3, 2.9)***	50.5	0.7 (0.5, 0.9)*	0.8 (0.5, 1.4)
≥ 5th	29.2	1.5 (1.1, 2.3)*	1.5 (0.9, 2.4)	21.5	0.5 (0.3, 0.7)**	0.9 (0.4, 1.8)
Delivery place						
Home	22.2	1.0	1.0	9.0	1.0	1.0
Hospital	77.8	1.1 (0.9, 1.5)	1.1 (0.8, 1.7)	91.0	2.7 (1.7, 4.2)**	1.9 (1.1, 3.3)*
Mode of delivery						
Normal vaginal delivery	95.7	1.0	1.0	90.0	1.0	1.0
Caesarean delivery	4.3	0.4 (0.3, 0.6)***	0.4 (0.3, 0.7)***	10.0	1.9 (1.2, 3.2)**	1.3 (0.8, 2.3)

*p<0.05, **p<0.01, ***p<0.001.
[a]Odds Ratio.
[b]Adjusted odds ratio (aOR) and their 95% confidence intervals (CI) were obtained with statistical adjustment for all of the variables listed in this table.

Table 3. Determinants of exclusive breastfeeding and predominant breastfeeding among mothers with children aged 0~5 months (*N*=1656)

Variable	%	Exclusive breastfeeding OR (95%CI)[a]	aOR (95% CI)[b]	%	Predominant breastfeeding OR (95%CI)[a]	aOR (95% CI)[b]
Sociodemographic variable						
Child's age (months)						
0~1	36.6	1.0	1.0	34.7	1.0	1.0
2~3	44.9	0.3 (0.2, 0.5)***	0.3 (0.2, 0.5)***	44.3	2.3 (1.3, 4.3)***	2.2 (1.0, 4.5)*
4~5	18.5	0.06 (0.04, 0.09)***	0.04 (0.03, 0.08)***	21.0	3.8 (2.1, 6.9)***	3.5 (1.6, 7.6)***
Mother's age (years)						
15~24	48.4	1.0	1.0	48.9	1.0	1.0
25~34	38.3	1.1 (0.8, 1.3)	1.12 (0.7, 1.7)	38.3	0.9 (0.5, 1.6)	1.2 (0.6, 2.3)
35~49	13.3	1.2 (0.8, 1.6)	1.3 (0.6, 2.8)	12.8	0.5 (0.2, 1.1)	0.9 (0.3, 2.9)
Mother's marital status						
Never married/divorced	11.2	1.0	1.0	11.1	1.0	1.0
Married/cohabiting	88.8	0.9 (0.6, 1.3)	0.6 (0.4, 1.1)	88.9	1.1 (0.5, 2.4)	1.4 (0.6, 3.1)
Mother's education						
No education	14.1	1.0	1.0	14.0	1.0	1.0
Primary school	68.8	1.2 (0.5, 1.1)	1.2 (0.7, 2.0)	68.6	1.2 (0.6, 2.4)	1.0 (0.4, 2.4)
≥Secondary school	17.2	1.4 (0.6, 1.2)	1.1 (0.5, 2.4)	17.5	1.5 (0.6, 3.9)	1.1 (0.4, 3.0)
Spouse's education						
No education	14.1	1.0	1.0	14.0	1.0	1.0
Primary school	56.8	1.1 (0.8, 1.5)	1.3 (0.8, 2.0)	68.6	0.7 (0.4, 1.2)	0.7 (0.3, 1.3)
≥Secondary school	29.1	1.3 (0.9, 1.9)	1.3 (0.8, 2.3)	17.5	1.1 (0.5, 2.3)	1.1 (0.5, 2.2)
Mother's working status						
Not working	35.3	1.0	1.0	35.0	1.0	1.0
Working	64.7	0.7 (0.6, 0.9)*	0.8 (0.5, 1.1)	65.0	1.0 (0.8, 1.4)	1.1 (0.6, 1.9)
Mother's place of residence						
Urban	13.5	1.0	1.0	13.9	1.0	1.0
Rural	86.5	0.9 (0.6, 1.3)	1.1 (0.6, 2.0)	86.1	0.7 (0.2, 1.8)	0.7 (0.2, 2.0)
Obstetric variable						
Antenatal visits						
None	1.5	1.0	1.0	1.9	1.0	1.0
1~3 visits	58.0	3.5 (1.8, 6.9)**	2.7 (1.0, 7.2)*	58.2	0.4 (0.1, 1.2)	0.4 (0.1, 1.2)
≥4 visits	40.5	3.8 (1.9, 7.8)**	3.4 (1.3, 9.1)*	39.9	0.3 (0.1, 0.9)*	0.3 (0.1, 0.8)*
Child's birth order						
1st	22.3	1.0	1.0	22.9	1.0	1.0
2nd~4th	50.3	1.2 (0.9, 1.5)	1.2 (0.8, 1.9)	50.6	0.8 (0.5, 1.2)	0.8 (0.4, 1.6)
≥5th	27.4	1.2 (0.9, 1.7)	1.6 (0.8, 3.0)	26.5	0.5 (0.3, 0.9)*	0.4 (0.2, 1.1)
Delivery place						
Home	18.9	1.0	1.0	19.1	1.0	1.0
Hospital	81.1	1.7 (1.3, 2.2)***	1.7 (1.1, 2.5)**	80.9	0.8 (0.5, 1.3)	1.0 (0.6, 1.7)
Mode of delivery						
Normal vaginal delivery	95.1	1.0	1.0	95.2	1.0	1.0
Caesarean delivery	4.9	1.0 (0.6, 1.7)	0.8 (0.4, 1.5)	4.8	0.7 (0.2, 2.2)	0.6 (0.2, 2.3)

*$p<0.05$, ** $p<0.01$, *** $p<0.001$.
[a]Odds Ratio
[b]Adjusted odds ratio (aOR) and their 95% confidence intervals (CI) were obtained with statistical adjustment for all of the variables listed in this table.

95% CI: 1.6, 7.6; *p*<0.001). The odds for predominant breast-feeding were lower for mothers with frequent antenatal care visits than mothers with fewer antenatal visits (OR for ≥4 visits =0.3 95% CI: 0.1, 0.8; *p*=0.02) (Table 3).

Determinants of bottle feeding

In the univariate analysis, child's age, mother's or spouse's education, frequent antenatal care visits, birth order, place of

delivery, mode of delivery, and place of residence were significantly associated with bottle feeding. The variables which remained significant in multivariate analysis, included older infants (OR for 12~23 months =3.5, 95% CI: 1.1, 10.8; p=0.03), secondary and higher education (OR=3.4, 95% CI: 1.6, 7.1; p<0.001), and hospital delivery (OR=1.9, 95% CI: 1.1, 3.3; p=0.03). Further, there was a positive association between the working status and bottle feeding (OR=1.4, 95% CI: 1.1, 2.0; p<0.05). However, the mother's age, marital status, spouse's education, frequent antenatal care visits, birth order, mode of delivery, and place of residence were not significant even after the adjustments (Table 2).

Determinants of bottle feeding among mothers who delivered in the hospital

For mothers with children aged 0~23 months who delivered in the hospital, child's age, mother's age, marital status, place of residence, mother's education or spouse's education, child's birth order and mode of delivery were significantly associated with bottle feeding in the univariate analysis. In multivariate analysis, older infants (OR for 6~11 months =2.5, 95% CI: 1.1, 5.9; p<0.001; OR for 12~23 months =2.5, 95% CI: 1.1, 5.8; p=0.03), mother's education (OR for primary school =2.4, 95% CI: 1.2, 4.6; p=0.01; OR for secondary and higher school=5.1, 95% CI: 2.5, 10.5; p<0.001), spouse's education (OR for primary school =0.6, 95% CI: 0.3, 0.9; p=0.02) and mother's working status (OR=1.5, 95% CI: 1.1, 2.1; p=0.008) remained significantly associations with bottle feeding (Table 4).

The Variance Inflation Factor for all the variables in table 2, 3 and 4 was between the ranges of 1.04~1.08, while the Value of Tolerance for the variables ranged from 0.50 to 0.96, suggesting lack of multicollinearity between the variables.

Discussion

The current study adopted a large nationally representative dataset with a high response rate (98%) to examine the prevalence of breastfeeding practices and its associated factors in Malawi. The majority of Malawian mothers (95.4%) initiated breastfeeding within 1 hour after birth, and 71.3% continued exclusive breastfeeding in the first 6 months postpartum. These rates were higher than those reported in Nigeria and Pakistan.[24,26] Very few infants were predominantly breastfed (6.1%) or bottle fed (3.8%) in the sample. We found that frequent antenatal care visits, hospital delivery, and cesarean delivery were significantly associated with early initiation and exclusive breastfeeding up to 6 months. In addition, mothers who had a higher level of education were more likely to practice bottle feeding. As alluded earlier, predominant breastfeeding was more common as the age of the infant increased.

Early initiation of breastfeeding and exclusive breastfeeding increased in recent years and are relatively high in Malawi, compared to other developing countries in Africa and Asia. The prevalence of early initiation of breastfeeding in Malawi increased from 75% in 2004 to 95% in 2010.[21] Similarly, the percentage of exclusive breastfeeding increased from 53.3% to 71.3% in the same period.[21] Both estimates were also higher

than those of developing countries in Africa, like Nigeria (14%),[24] Tanzania (49.9%), and Ethiopia (49%).[6] Furthermore, optimal breastfeeding practices were higher and increased more in Malawi during the same period than those of developed countries, such as the USA (16.8%)[27] and Taiwan (17.9%).[28] According to the WHO (2016), appropriate breastfeeding strategies such as BFHI measures, are linked to higher rates of early initiation and exclusive breastfeeding for up to 6 months. In Malawi, 26 hospitals were designated as Baby-Friendly by Malawi Ministry of Health (MOH) from 1993 to 2004[29] and over 1000 health care staffs have been trained with the Ten steps of BFHI standards.[30] Considering that the majority of women in our study delivered at the hospital (77.8%), BFHI measures provided in health systems would help to sustain exclusive breastfeeding.[4] The national advocacy for breastfeeding may have contributed to the increased rates of optimal breastfeeding practices in Malawi. Nonetheless, the 71.3% exclusive breastfeeding rate in Malawi is still lower than the WHO breastfeeding goal of 90%,[7] suggesting the need for additional strategies to improve exclusive breastfeeding.

Consistent with reports from Nigeria[24] and Iran,[31] we found that exclusive breastfeeding had significantly decreased as infants reached 6 months of age. Mothers seem to be more likely to practice non-exclusive breastfeeding, such as predominant breastfeeding or bottle feeding as the child's age increases and tend to cease exclusive breastfeeding before 6 months, a minimum period of exclusive breastfeeding recommended by WHO. This may be explained by the early introduction of food supplements,[9] loss of motivation,[32] painful breasts due to constant sucking or infant teething,[33] fear of losing breast shape, and insufficient breastmilk supply.[34] Although the Malawian government continues to promote breastfeeding by scheduled home visits starting from the third trimester of pregnancy through 5 months postpartum, the aforementioned issues remain potential barriers to exclusive breastfeeding.[35]

Consistent with a report from Brazil,[36] we found that mothers who made frequent antenatal visits tended to practice optimal breastfeeding and were less likely to practice predominant breastfeeding compared to mothers with no antenatal visits. It is possible that knowledge and skills acquired during antepartum visits may strengthen mothers' confidence and intention to breastfeed.[32] During prenatal visits, Malawian mothers are routinely provided with breastfeeding education, and such educational sessions are associated with optimal breastfeeding outcomes.[37] Meanwhile, health care providers in the prenatal care settings often promote and advocate breastfeeding by encouraging both mother's and father's involvement to maximize the effects of prenatal education on breastfeeding.[38] In addition, the promotion of professional-led interventions, which encompass a clear description of staff training and intervention protocols may be beneficial for optimizing breastfeeding practices.[35]

The result of a negative association between caesarean delivery and early initiation of breastfeeding was consistent with a study conducted in Kuwait.[39] It is possible that mothers who deliver via a caesarean section often experience postoperative pain,[40] and in some cases tend to perceive insufficient milk supply, thereby impeding early initiation. Immediate postpartum care, such as mother-infant contact assistance, has

Table 4. Determinants of bottle feeding among mothers who delivered in the hospital and with children aged 0~23 months (*N*=5661)

Variable	Bottle feeding		
	%	OR (95%CI)[a]	aOR (95%CI)[b]
Sociodemographic variable			
Child's age (months)			
0~1	2.3	1.0	1.0
2~3	2.4	0.6 (0.2, 2,0)	0.6 (0.2, 1.9)
4~5	5.5	2.0 (0.8, 5.1)	1.8 (0.7, 4.7)
6~11	26.0	2.8 (1.2, 6.6)**	2.5 (1.1, 5.9)***
12~23	63.8	2.7 (1.2, 6.2)*	2.5 (1.1, 5.8)*
Mother's age (years)			
15~24	39.0	1.0	1.0
25~34	49.6	1.3 (1.0, 1.8)*	1.3 (0.9, 1.9)
35~49	11.4	0.9 (0.6, 1.4)	1.4 (0.7, 2.5)
Mother's marital status			
Never married/divorced	16.9	1.0	1.0
Married/cohabiting	83.1	0.7 (0.5, 0.9)*	0.7 (0.5, 1.0)
Mother's education			
No education	3.9	1.0	1.0
Primary school	45.3	2.4 (1.3, 4.6)*	2.4 (1.2, 4.6)**
≥Secondary school	50.8	10.3 (5.5, 19.5)***	5.1 (2.5, 10.5)***
Spouse's education			
No education	13.8	1.0	1.0
Primary school	30.7	0.5 (0.3, 0.7)**	0.6 (0.3, 0.9)*
≥Secondary school	55.5	1.7 (1.2, 2.5)**	0.9 (0.5, 1.4)
Mother's working status			
Not working	23.5	1.0	1.0
Working	76.5	1.3 (0.9, 1.7)	1.5 (1.1, 2.1)**
Mother's place of residence			
Urban	37.8	1.0	1.0
Rural	62.2	0.3 (0.2, 0.4)**	0.7 (0.5, 1.0)
Obstetric variable			
Antenatal visits			
None	2.0	1.0	1.0
1~3 visits	47.5	0.6 (0.2, 1.4)	0.4 (0.2, 1.1)
≥4 visits	50.5	0.7 (0.3, 1.7)	0.4 (0.2, 1.2)
Child's birth order			
1st	29.8	1.0	1.0
2nd~4th	48.6	0.7 (0.5, 0.9)*	0.8 (0.5, 1.2)
≥5th	21.6	0.6 (0.4, 0.8)**	1.0 (0.6, 1.7)
Mode of delivery			
Normal vaginal delivery	89.0	1.0	1.0
Caesarean delivery	11.0	2.0 (1.3, 3.1)**	1.3 (0.8, 2.0)

*p<0.05, ** p<0.01, *** p<0.001.
[a]Odds Ratio
[b]Adjusted odds ratio (aOR) and their 95% confidence intervals (CIs) were obtained with statistical adjustment for all of the variables listed in this table

been shown to help mothers after caesarean delivery to achieve better breastfeeding outcomes.[41]

Our results indicated that mothers who delivered in the hospital were more likely to exclusively breastfeed their infants for the first 6 months, compared to mothers who delivered at home. This is corroborated by similar findings from a study conducted in Ghana,[42] which indicated that hospital delivery may facilitate appropriate breastfeeding practices. Prior research

conducted in Korea[32] also suggested that providing in-room guidance services to nursing mothers was effective in promoting exclusive breastfeeding among postpartum mothers.

Interestingly, our results indicated that hospital delivery was also a significant determinant of bottle feeding for children aged 0~23 months. Similar studies conducted in the USA and Nigeria also reported that early breastfeeding cessation replaced by bottle feeding was more likely to occur among mothers who delivered in the hospital than those who delivered at home.[24,43] Some factors encouraging bottle feeding for mothers who delivered in the hospital may include in-hospital formula supplementation, the perceptions of insufficient milk, and poor latching of baby.[43] The contrary findings in regard to hospital delivery were potentially related to various types of breastfeeding support and the availability of formula in each hospital. Despite the mixed results, it is generally considered as beneficial to provide continuous breastfeeding support to increase exclusive breastfeeding in the first 6-month postpartum. Additionally, the complexity inherent in hospital services and its relation to breastfeeding practices warrant further investigations.

Multiparous mothers in our sample tended to practice early initiation of breastfeeding, compared to mothers with fewer childbirths. This is concordant with findings from Nigeria.[24] It is possible that multiparous mothers have previous breastfeeding experience and are thus more likely to initiate breastfeeding early.[44] However, research also indicates that some primiparous mothers may experience high levels of perceived stress, thus requiring additional breastfeeding assistance.[45] Therefore, hands-on instruction for breastfeeding and continuous support after delivery for mothers are particularly recommended.

We found that educated mothers in Malawi tended to have higher odds of practicing bottle feeding, which was similar to the result reported in Nigeria.[24] Further, our results indicated a positive association between mother's working status and bottle feeding among mothers who delivered in the hospital. A previous study conducted in Nigeria revealed that working mothers were more likely to practice bottle feeding compared to non-working mothers.[46] These findings might be partially explained by the fact that educated mothers tend to have a higher chance of employment, may need to resume work early, and thus tend to practice bottle feeding.[47] It is also possible that working mothers may have additional financial resources to purchase formula and supplemental food compared to non-working mothers who rely solely on breast milk for baby's nutrition.

Recommendations

Our study reveals that breastfeeding education and support provided at antenatal care visits as well as hospital care after childbirth is critical for improving rates of early initiation and exclusive breastfeeding in Malawi. Efforts to increasing Baby-Friendly designated health facilities and adherence to ten steps of BFHI will engage both mothers and fathers in optimal breastfeeding. Specifically, it is important to expand current hospital-based breastfeeding interventions to the community setting, such as home visits focusing on the education of exclusive breastfeeding.

Limitations

The limitations of this study should be taken into account when interpreting our results. Firstly, breastfeeding practices were based on the mother's recall of what the child had eaten on the day prior to the survey. This is a potential source of measurement bias since mothers might have incorrectly or insufficiently recalled what she had given the infant, a day before the survey interview. Secondly, the cross-sectional design of the survey does not allow the interpretation of causality between the determinants and breastfeeding practices. However, the use of a nationally representative sample in our study provides comprehensive results on breastfeeding practices and their associated determinants, which may allow generalizability of our study findings, to a large extent. Thirdly, an overlap may exist in the definitions of predominant breastfeeding and bottle feeding indicators for infants fed with both breast milk and formula. Nevertheless, most prior breastfeeding studies adopted the same definitions recommended by WHO and hence allow comparison across different studies.

Conclusions

In Malawi, the prevalence of early initiation of breastfeeding has satisfactorily been increasing. However, the exclusive breastfeeding rate is currently still falling short of the WHO breastfeeding goal. Our study showed that optimal breastfeeding practices were associated with frequent antenatal care visits, delivery at a hospital, and increased birth order. The prenatal breastfeeding education and counselling at the antenatal visits and postnatal breastfeeding care provided during hospital stay after childbirth as recommended by BFHI are important strategies for promoting early initiation of breastfeeding and exclusive breastfeeding. Continuous efforts and resources to integrate BFHI into perinatal care are warranted for sustainable breastfeeding practices.

Competing interests: None declared.

References

1 Binns C, Lee M, Low WY. The long-term public health benefits of breastfeeding. Asia Pac J Public Health. 2016;28(1):7–14.

2 Victora CG, Bahl R, Barros AJ, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. Lancet. 2016;387 (10017):475–90.

3 Kandala N-B, Magadi MA, Madise NJ. An investigation of district spatial variations of childhood diarrhoea and fever morbidity in Malawi. Soc Sci Med. 2006;62(5):1138–52.

4 WHO/UNICEF. Global nutrition targets 2025: breastfeeding policy brief (WHO/NMH/NHD/14.7). Geneva: World Health Organization; 2014. https://www.who.int/nutrition/publications/globaltargets2025 _policybrief_breastfeeding/en/ (accessed 10 November 2018).

5 Kavle JA, Welch PR, Bwanali F, et al. The revitalization and scale-up of the Baby-Friendly Hospital Initiative in Malawi. Matern Child Nutr. 2019;15:e12724.

6 Issaka AI, Agho KE, Renzaho AM. Prevalence of key breastfeeding indicators in 29 sub-Saharan African countries: a meta-analysis of demographic and health surveys (2010–2015). BMJ Open. 2017;7 (10):e014145.

7 Cai X, Wardlaw T, Brown DW. Global trends in exclusive breastfeeding. Int Breastfeed J. 2012;7(1):12.

8 Pérez-Escamilla R, Martinez JL, Segura-Pérez S. Impact of the Baby-friendly Hospital Initiative on breastfeeding and child health outcomes: a systematic review. Matern Child Nutr. 2016;12(3):402–17.

9 Osorio Castaño JH, Botero Ortiz BE. Factors associated to the duration of exclusive breastfeeding. Invest Educ Enferm. 2012;30(3):390–7.

10 Vaahtera M, Kulmala T, Hietanen A, et al. Breastfeeding and complementary feeding practices in rural Malawi. Acta Paediatr. 2001;90 (3):328–32.

11 Kalanda BF, Verhoeff FH, Brabin B. Breast and complementary feeding practices in relation to morbidity and growth in Malawian infants. Eur J Clin Nutr. 2006;60(3):401–7.

12 Kamudoni P, Maleta K, Shi Z, et al. Breastfeeding perceptions in communities in Mangochi district in Malawi. Acta Paediatr. 2010;99(3): 367–72.

13 Kumwenda C, Hemsworth J, Phuka J, et al. Factors associated with breast milk intake among 9–10-month-old Malawian infants. Matern Child Nutr. 2016;12(4):778–89.

14 Kamudoni P, Maleta K, Shi Z, et al. Exclusive breastfeeding duration during the first 6 months of life is positively associated with length-for-age among infants 6–12 months old, in Mangochi district, Malawi. Eur J Clin Nutr. 2015;69(1):96.

15 Kafulafula UK, Hutchinson MK, Gennaro S, et al. Exclusive breastfeeding prenatal intentions among HIV-positive mothers in Blantyre, Malawi: a correlation study. BMC Pregnancy Childbirth. 2013;13(1):203.

16 Kazembe L. Spatial modelling of initiation and duration of breastfeeding: analysis of breastfeeding behaviour in Malawi-I. World Health Popul. 2007;10(3):14–31.

17 Rollins NC, Bhandari N, Hajeebhoy N, et al. Why invest, and what it will take to improve breastfeeding practices? Lancet. 2016;387 (10017):491–504.

18 Amin T, Hablas H, Al Qader AA. Determinants of initiation and exclusivity of breastfeeding in Al Hassa, Saudi Arabia. Breastfeed Med. 2011;6(2):59–68.

19 Senarath U, Dibley M, Agho K. Breastfeeding practices and associated factors among children under 24 months of age in Timor-Leste. Eur J Clin Nutr. 2007;61(3):387–97.

20 National Statistical Office, ICF Macro. Malawi Demographic and Health Survey 2004. Zomba, Malawi and Calverton, MD, USA: National Statistical Office and ICF Macro; 2005.

21 National Statistical Office, ICF Macro. Malawi Demographic and Health Survey 2010. Zomba, Malawi and Calverton, MD, USA: National Statistical Office and ICF Macro; 2011.

22 World Health Organization. Indicators for assessing infant and young child feeding practices: part 1: definitions: conclusions of a consensus meeting held 6–8 November 2007 in Washington DC, USA; 2008.

23 UNICEF. Suggestions for CRC Committee's Concluding Observations on Infant and Young Child Feeding; 2016.

24 Ogbo FA, Agho KE, Page A. Determinants of suboptimal breastfeeding practices in Nigeria: evidence from the 2008 demographic and health survey. BMC Public Health. 2015;15(1):259.

25 Dormann CF, Elith J, Bacher S, et al. Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. Ecography. 2013;36(1):27–46.

26 Hazir T, Akram D-S, Nisar YB, et al. Determinants of suboptimal breast-feeding practices in Pakistan. Public Health Nutr. 2013;16(4): 659–72.

27 Bartick M, Reinhold A. The burden of suboptimal breastfeeding in the United States: a pediatric cost analysis. Pediatrics. 2010;125(5): e1048–56.

28 Chien LY, Tai CJ. Effect of delivery method and timing of breastfeeding initiation on breastfeeding outcomes in Taiwan. Birth. 2007;34 (2):123–30.

29 UNICEF. Breastfeeding on the worldwide agenda: Findings from a landscape analysis on political commitment for programmes to protect, promote and support breastfeeding; 2013.

30 World Health Organisation. Baby Friendly Hospital initiative, experiences from Malawi; 2016. https://www.fsnnetwork.org/sites/default/ files/baby_friendly_hopsital_initiative_experiences_from_malawi.pdf (accessed 10 September 2018).

31 Saffari M, Pakpour AH, Chen H. Factors influencing exclusive breastfeeding among Iranian mothers: a longitudinal population-based study. Health Promot Perspect. 2017;7(1):34.

32 Kim S, Park S, Oh J, et al. Interventions promoting exclusive breastfeeding up to six months after birth: A systematic review and meta-analysis of randomized controlled trials. Int J Nurs Stud. 2018;80: 94–105.

33 Agunbiade OM, Ogunleye OV. Constraints to exclusive breastfeeding practice among breastfeeding mothers in Southwest Nigeria: implications for scaling up. Int Breastfeed J. 2012;7(1):5.

34 Hector D, King L, Webb K, et al. Factors affecting breastfeeding practices. Applying a conceptual framework. N S W Public Health Bull. 2005;16(4):52–5.

35 Lewycka S, Mwansambo C, Kazembe P, et al. A cluster randomised controlled trial of the community effectiveness of two interventions in rural Malawi to improve health care and to reduce maternal, newborn and infant mortality. Trials. 2010;11(1):88.

36 Vieira TO, Vieira GO, Giugliani ERJ, et al. Determinants of breastfeeding initiation within the first hour of life in a Brazilian population: cross-sectional study. BMC Public Health. 2010;10(1):760.

37 Mueller DH, Lungu D, Acharya A, et al. Constraints to implementing the essential health package in Malawi. PLoS One. 2011;6(6):e20741.

38 Bich TH, Hoa DTP, Ha NT, et al. Father's involvement and its effect on early breastfeeding practices in Viet Nam. Matern Child Nutr. 2016; 12(4):768–77.

39 Dashti M, Scott JA, Edwards CA, et al. Determinants of breastfeeding initiation among mothers in Kuwait. Int Breastfeed J. 2010;5(1):7.

40 Thompson JF, Roberts CL, Currie M, et al. Prevalence and persistence of health problems after childbirth: associations with parity and method of birth. Birth. 2002;29(2):83–94.

41 Rowe-Murray HJ, Fisher JR. Baby friendly hospital practices: cesarean section is a persistent barrier to early initiation of breastfeeding. Birth. 2002;29(2):124–31.

42 Aidam BA, Perez-Escamilla R, Lartey A, et al. Factors associated with exclusive breastfeeding in Accra, Ghana. Eur J Clin Nutr. 2005;59(6): 789–96.

43 Chantry CJ, Dewey KG, Peerson JM, et al. In-hospital formula use increases early breastfeeding cessation among first-time mothers intending to exclusively breastfeed. J Pediatr. 2014;164(6):1339–45.

44 Lessen R, Crivelli-Kovach A. Prediction of Initiation and Duration of Breast-feeding for Neonates Admitted to the Neonatal Intensive Care Unit. J Perinat Neonatal Nurs. 2007;21(3):256–66.

45 Bastani F, Rahmatnejad L, Jahdi F, et al. Breastfeeding self efficacy and perceived stress in primiparous mothers. Iran J Nurs. 2008;21 (54):9–24.

46 Ogunlesi TA. Maternal socio-demographic factors influencing the initiation and exclusivity of breastfeeding in a Nigerian semi-urban setting. Matern Child Health J. 2010;14(3):459–65.

47 Agbo H, Envuladu E, Adams H, et al. Barriers and facilitators to the practice of exclusive breast feeding among working class mothers: a study of female resident doctors in tertiary health institutions in Plateau State. J Med Res. 2013;2(1):112–6.