

# Determinants of trends in breast-feeding indicators in Nigeria, 1999–2013

Felix Akpojene Ogbo<sup>1,\*</sup>, Andrew Page<sup>1</sup>, Kingsley E Agho<sup>1</sup> and Fernanda Claudio<sup>2</sup>

<sup>1</sup>School of Science and Health, University of Western Sydney, Campbelltown Campus, Locked Bag 1797, Penrith, NSW 2571, Australia; <sup>2</sup>School of Social Science, The University of Queensland, Brisbane, Australia

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## Abstract

**Objective:** The present study aimed to examine the trends and differentials in key breast-feeding indicators in Nigeria for the period 1999–2013.

**Design:** Longitudinal study of trends (1999–2013) in optimal feeding practices using a series of population-based Nigerian Demographic and Health Surveys. Trends in socio-economic, health service and individual characteristics associated with key breast-feeding indicators were examined using multilevel regression analyses.

**Setting:** Nigeria.

**Subjects:** Children (*n* 88 152) aged under 24 months (*n* 8199 in 1999; *n* 7620 in 2003; *n* 33 385 in 2008; *n* 38 948 in 2013).

**Results:** Among educated mothers, there was an increase in prevalence of exclusive breast-feeding (26 % in 1999 to 30 % in 2013) and predominant breast-feeding (27 % in 1999 to 39 % in 2013) compared with mothers with no schooling. A similar increasing trend was evident for mothers from wealthier households and mothers who had a higher frequency of health service access compared with mothers from poorer households and women who reported no health service access, respectively. Mothers with no schooling predominantly breast-fed, but the odds for bottle-feeding were higher among educated mothers and women from wealthier households. The odds for early initiation of breast-feeding were lower for mothers who reported no health service contacts and mothers of lower socio-economic status.

**Conclusions:** Significant increasing trends in key breast-feeding indicators were evident among mothers with higher socio-economic status and mothers who had more health service access in Nigeria. Broader national and sub-national policies that underpin nursing mothers in work environments and a comprehensive community-based approach are proposed to improve feeding practices in Nigeria.

**Keywords**  
Breast-feeding  
Mortality  
Nigeria  
Trends

Breast-feeding is crucial for the healthy growth and development of the child<sup>(1,2)</sup>. Appropriate breast-feeding improves childhood immunity and reduces the incidence of gastroenteritis, malnutrition, otitis media, obesity and sudden infant death syndrome, as well as childhood mortality<sup>(3–5)</sup>. WHO/UNICEF has recommended the initiation of breast-feeding within the first hour of birth for all newborns, exclusive breast-feeding (EBF) until 6 months of age and continued breast-feeding until 2 years and beyond, including introduction of timely, adequate and safe complementary food at 6 months of age<sup>(6–9)</sup>. Despite these recommendations, a recent global estimate found that only 38 % of infants are exclusively breast-fed for the first 4 months of life<sup>(7)</sup>. Approximately 1.5 million lives of infants and young children are lost due to

suboptimal feeding behaviours in developing countries including Nigeria<sup>(10)</sup>.

In 1992, following global recommendations, Nigeria introduced the Baby-Friendly Hospital Initiative to protect, support and promote breast-feeding among mothers<sup>(11)</sup>, which resulted in improvements in EBF and early initiation of breast-feeding<sup>(12–14)</sup>, and which has been shown to have significant impacts on neonatal diarrhoea, diarrhoeal dehydration and neonatal mortality elsewhere<sup>(15)</sup>. However, EBF prevalence in Nigeria has declined over time (from 28 % in 1999<sup>(14)</sup> to 17 % in 2013<sup>(13)</sup>) and remains well below the recommended prevalence of 60 %<sup>(16)</sup> needed to achieve Millennium Development Goal 4<sup>(17)</sup>. In contrast, the prevalence of bottle-feeding among Nigerian women has increased<sup>(18,19)</sup>, with evidence from regional

\*Corresponding author. Email 17449931@student.uws.edu.au; felgbo@yahoo.co.uk

studies suggesting an increase in bottle-feeding prevalence among infants from 16% in 2008<sup>(18)</sup> to 27% in 2011<sup>(19)</sup>.

Few studies in Nigeria have investigated the determinants for these changes in optimal feeding practices. A recent study focused on determinants for early initiation of breast-feeding found that socio-economic factors (such as higher maternal education, employment and urban residency) and health service factors (such as higher frequency of antenatal visits and vaginal deliveries) positively impacted early initiation of breast-feeding, which also differed in magnitude over time<sup>(12)</sup>. Nigeria is a society undergoing significant social and economic change<sup>(20)</sup>. Globalization, a developing economy and changing political regime have engendered the growth of a new middle class in which familial and gender role differentiation (including social mobility of women) is in transition and may potentially be impacting infant and young child feeding (IYCF) practices<sup>(21)</sup>.

To date, no studies have examined the key determinants of secular changes in other key breast-feeding indicators, including EBF, predominant breast-feeding and bottle-feeding. Accordingly, the main purpose of the present study was to examine trends and differentials in key breast-feeding indicators (i.e. early initiation of breast-feeding, EBF, predominant breast-feeding, bottle-feeding) by socio-economic factors, health service factors and individual characteristics using the Nigeria Demographic and Health Survey (NDHS) data over a period spanning 1999–2013. Findings from the study will provide an evidence base to policy makers and public health experts to evaluate the impact of previous interventions on feeding behaviours in Nigeria and to identify key drivers of changes to optimal feeding practices.

## Methods

### Data sources

The analysis was based on publicly available data sets collected for the NDHS for the years 1999, 2003, 2008 and 2013, conducted by the National Population Commission and ICF Macro<sup>(13,14,18,22)</sup>. The NDHS – a significant source of information on IYCF practices<sup>(23)</sup> – collected information on IYCF practices (among other factors) from a nationally representative sample of households using the 1991 and 2006 census frames<sup>(18,22)</sup>. The NDHS data for 1999, 2003, 2008 and 2013 contained sociodemographic and eligible maternal responses from 8199, 7620, 33 385 and 38 948 mothers of reproductive age, respectively. The increase in sample size in the latter periods reflects growth in the Nigerian population and a broader survey scope to include additional modules of questions and geographic areas within geopolitical regions (to facilitate geo-coding). A total of 88 152 mothers were participants in the four data sets, with response rates ranging from 92 to 98%. The samples were selected in a stratified two-stage cluster design.

Using a face-to-face questionnaire, data on maternal and child's demographics, breast-feeding and reproductive practices, as well as contraceptive and infant feeding practices, were collected.

### Key breast-feeding indicators

The infant feeding indicators were assessed using the WHO recommended definition of breast-feeding indicators for assessing IYCF practices<sup>(7,9,23)</sup>. In the analysis, the main outcome factors were early initiation of breast-feeding within the first hour of birth, EBF, predominant breast-feeding and bottle-feeding using the following definitions.

1. Early initiation of breast-feeding: the proportion of children 0–23 months of age who were put to the breast within an hour of birth – this indicator was based on mother's recall.
2. Exclusive breast-feeding: the proportion of infants 0–5 months of age who received breast milk as the only source of nourishment (but allow oral rehydration solution, drops or syrups of vitamins and medicines) – this indicator was based on mother's recall on feeds given to the infant in the last 24 h.
3. Predominant breast-feeding: the proportion of infants 0–5 months of age who received breast milk as the predominant source of nourishment (but which allows water and water-based drinks, fruit juice, ritual fluids, oral rehydration solution, syrups or drops of vitamins) during the previous day.
4. Bottle-feeding rate: the proportion of infants 0–23 months of age who received any liquid (including breast milk) or semi-solid food from a bottle with nipple/teat.

In addition, EBF and early initiation of breast-feeding were included in analyses because of their association with infant nutrition, decreased morbidity and mortality among children under 5 years of age<sup>(2,24)</sup>. Predominant breast-feeding and bottle-feeding were included due to their impacts on the increased risk of diarrhoeal illness and increased risk for childhood mortality<sup>(6,7,25,26)</sup>. Each of these breast-feeding indicators was expressed as a dichotomous outcome. For example, respondents who exclusively breast-fed were coded as '1' and those who did not were coded as '0'<sup>(17,27)</sup>. The same approach was employed for the other breast-feeding indicators.

### Study factors

Study factors included a range of socio-economic, health service and individual factors. Socio-economic characteristics included the mother's highest educational level (categorized as no education, primary education or secondary and above education) and employment status (categorized as not working or working in the past 12 months preceding the survey), household wealth index (categorized as poor, middle or rich) and partner's highest

educational level (categorized as no education, primary education or secondary and above education). The household wealth index was calculated as a score of household assets such as ownership of transportation devices, ownership of durable goods and household facilities, which was derived from a principal components analysis conducted by the National Population Commission and ICF Macro based on a methodology developed from previous Demographic and Health Surveys<sup>(13,14,18)</sup>. Principal components analysis was used to determine the weights for the wealth index based on information collected about household assets and facilities. The household wealth index was divided into three groups and labelled poor, middle and rich. Each household was assigned to one of these groups. The wealth index was constructed using methods recommended by the World Bank Poverty Network and UNICEF as described by Filmer and Pritchett<sup>(28)</sup>, and was used in similar previously published studies<sup>(17,28)</sup>.

Health service factors included the number of antenatal clinic (ANC) visits (categorized as no antenatal visit, one to three antenatal visits or four and above antenatal visits, reflecting the WHO four-visit ANC model for focused antenatal care<sup>(29)</sup>), the place of delivery (home or health facility) and mode of delivery (caesarean section or vaginal). Type of delivery assistance received was also included and was categorized as health professionals, traditional birth attendants or untrained personnel. A traditional birth attendant is usually a woman who assists the mother during childbirth and who initially acquired her skills by delivering babies herself, or by working with other traditional birth attendants<sup>(30)</sup>. Also, the place and mode of delivery were combined to see the effect of caesarean deliveries and home deliveries on early initiation of breast-feeding<sup>(12,27)</sup>, acknowledging that most Nigerian women give birth at home<sup>(13)</sup> and there is an increase in prevalence of caesarean section in Nigerian health facilities<sup>(31,32)</sup>. Individual characteristics included age of the child in months.

### **Statistical analysis**

Differences in the prevalence of breast-feeding indicators (early initiation of breast-feeding, EBF, predominant breast-feeding and bottle-feeding) were examined over the study period (1999–2013), stratified by socio-economic, health service and individual-level variables to determine absolute changes in prevalence. Prevalences and calculation of standard errors were adjusted using sampling weights to account for the cluster sampling design.

Relative differences between study factors were investigated using a series of univariable and multivariable multilevel logistic regression models. Study variables included socio-economic factors (employment status, maternal and partner's education, household wealth index)<sup>(12,17,27,33,34)</sup>, health service factors (place of delivery, mode and place of delivery, antenatal visits, delivery assistance)<sup>(12,17,27,33,35)</sup> and individual factors (child age)<sup>(17,27)</sup>.

Trends over the period were assessed by specifying period as an ordinal variable in models, stratified by each level of a given study variable to assess the extent to which prevalence within groups was increasing or decreasing. The extent of divergence or convergence between the slopes of period-specific trends within each study variable over the study period was assessed by testing the interaction (*P* for interaction) between period and a given study variable over the study period (1999–2013).

Multivariable models adjusted for the potential confounding factors of geopolitical region, maternal age, birth interval and sex of the baby. In models of health service factors additional adjustment was made for socio-economic status (SES), as a common cause (confounder) of the association between health service factors and optimal breast-feeding indicators. Similarly, in models of individual factors, additional adjustment was made for SES and health service factors as confounders of the association between individual factors and breast-feeding indicators.

The models restricted analyses to the youngest living child aged less than 24 months living with the respondent (eligible women aged 15–49 years). All analyses were carried out using the statistical software package Stata version 13.0, with prevalences calculated using the 'Svy' function to allow for cluster sampling and regression modelling conducted using the 'xtlogit' function.

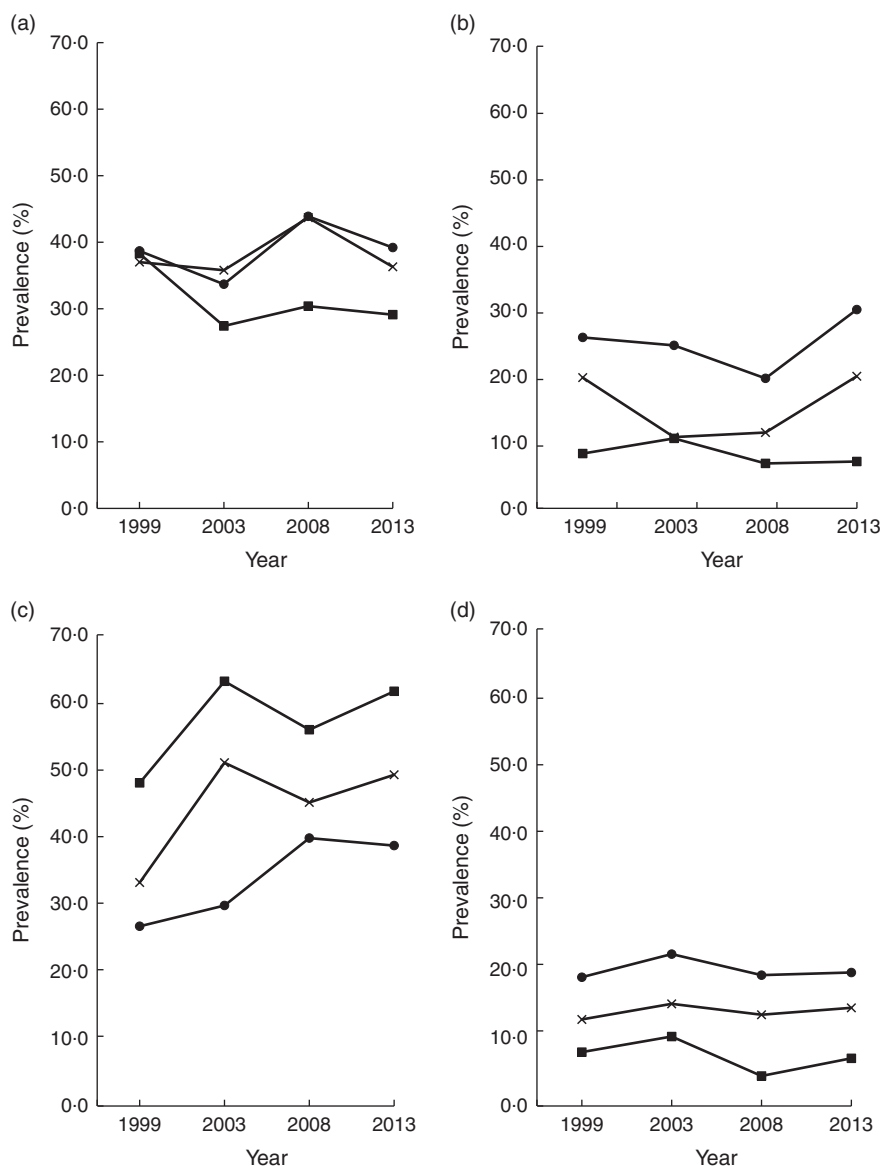
### **Ethics**

The Demographic and Health Surveys project sought and obtained the required ethical approvals from ethics committees in Nigeria before the surveys were conducted. Informed consent was obtained from study participants before they were allowed to participate in the surveys. The survey data sets used in the present study were completely anonymous with regard to participant identity. Approval was sought from MEASURE DHS/ICF International and permission was granted for this use.

### **Results**

#### **Early initiation of breast-feeding**

The proportion of mothers who engaged in early initiation of breast-feeding decreased significantly over the study period for mothers with no schooling but with a slight increase in the intervening year (2008) compared with educated mothers (Fig. 1(a)). Likewise, a similar decreasing trend was identified in mothers who received delivery assistance from non-health professionals (particularly untrained personnel) compared with mothers who received delivery assistance from health professionals (Table 1). Further, a similar decreasing trend was evident among mothers who delivered their babies by caesarean section, compared with mothers who delivered at home (Table 1). Mothers who delivered by caesarean section at a health facility were significantly less likely to initiate



**Fig. 1** Trends in key breast-feeding indicators by mother's education level (■, no education; ×, primary education; ●, secondary and above education): (a) early initiation of breast-feeding; (b) exclusive breast-feeding; (c) predominant breast-feeding; (d) bottle-feeding. Nigeria, 1999–2013

breast-feeding within the first hour of birth (2008–2013) compared with mothers who delivered at home. However, when place of delivery was stratified by home and health facility, the study found that mothers who delivered at a health facility were significantly more likely to initiate breast-feeding within the first hour of birth compared with mothers who delivered at home (Table 1). Mothers from wealthier households were significantly more likely to initiate breast-feeding within the first hour of birth compared with mothers from poorer households.

#### **Exclusive breast-feeding**

The study showed an increasing prevalence of EBF among educated mothers with some variability in the intervening years compared to mothers with no schooling (Fig. 1(b)).

A significant increasing trend was evident in mothers who made more than four ANC visits compared with mothers who had no ANC visits (Table 2). Educated mothers were significantly more likely to exclusively breast-feed their babies over the study period compared with mothers without schooling (Table 2). The odds for EBF were higher for mothers from wealthier households compared with mothers from poorer households. Mothers who delivered at the health facility were significantly more likely to exclusively breast-feed compared with mothers who delivered their babies at home. Similarly, mothers who had more than four ANC visits were significantly more likely to practise EBF compared with mothers who had no ANC visits. Increasing child age was significantly associated with a less likelihood of EBF.

**Table 1** Early initiation of breast-feeding by socio-economic, health service and individual characteristics, Nigeria, 1999–2013

Characteristic	1999					2008					2013					P for interaction	
	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI		P
<b>Socio-economic</b>																	
Mother's employment																	
Not working	41.6	1.00	Ref.		27.5	1.00	Ref.		34.1	1.00	Ref.		33.9	1.00	Ref.		<0.001
Working	34.7	0.65	0.51, 0.84	0.001	33.3	1.08	0.86, 1.36	0.513	40.0	1.17	1.05, 1.30	0.004	33.9	0.85	0.77, 0.94	0.001	0.001
Mother's education																	
No education	38.3	1.00	Ref.		27.4	1.00	Ref.		30.4	1.00	Ref.		29.1	1.00	Ref.		0.665
Primary education	37.0	1.05	0.77, 1.42	0.767	35.8	1.28	0.96, 1.70	0.094	43.7	1.36	1.04, 1.78	0.022	36.3	1.18	0.89, 1.55	0.242	0.008
Secondary and above education	38.7	1.35	0.99, 1.86	0.060	33.7	1.36	1.00, 1.85	0.052	43.9	1.29	0.98, 1.72	0.073	39.2	1.64	1.24, 2.16	<0.001	0.584
Father's education																	
No education	35.6	1.00	Ref.		26.0	1.00	Ref.		30.2	1.00	Ref.		27.4	1.00	Ref.		0.339
Primary education	39.4	1.42	1.05, 1.94	0.024	28.8	0.93	0.69, 1.25	0.609	39.1	1.12	0.96, 1.30	0.142	34.4	1.13	0.97, 1.30	0.108	0.044
Secondary and above education	39.8	1.57	1.18, 2.09	0.002	36.9	1.39	1.05, 1.85	0.020	43.8	1.20	1.04, 1.38	0.014	39.8	1.26	1.11, 1.44	0.001	0.303
Household poverty index																	
Poor	37.1	1.00	Ref.		27.6	1.00	Ref.		33.0	1.00	Ref.		27.7	1.00	Ref.		0.001
Middle	37.9	1.11	0.86, 1.43	0.406	31.8	1.10	0.86, 1.42	0.447	38.9	1.12	0.98, 1.28	0.091	35.8	1.27	1.12, 1.43	<0.001	0.962
Rich	41.6	1.42	0.99, 2.03	0.058	39.8	1.88	1.32, 2.67	<0.001	41.0	1.32	1.11, 1.58	0.002	42.4	1.61	1.37, 1.90	<0.001	0.107
Health service																	
Place of delivery																	
Home	37.1	1.00	Ref.		27.3	1.00	Ref.		34.0	1.00	Ref.		29.7	1.00	Ref.		0.003
Health facility	40.2	1.50	1.16, 1.95	0.002	38.3	1.57	1.21, 2.03	0.001	44.4	1.29	1.14, 1.47	0.001	40.7	1.64	1.46, 1.83	<0.001	0.816
Mode and place of delivery																	
Home	37.2	1.00	Ref.		27.3	1.00	Ref.		34.0	1.00	Ref.		29.7	1.00	Ref.		0.003
Health facility without caesarean	40.0	1.45	1.11, 1.90	0.007	39.3	1.60	1.23, 2.08	0.001	45.3	1.34	1.18, 1.53	<0.001	42.1	1.72	1.53, 1.93	<0.001	0.533
Health facility with caesarean	40.1	1.39	0.72, 2.69	0.326	18.6	1.00	0.39, 2.56	0.997	25.5	0.53	0.35, 0.80	0.003	21.1	0.55	0.40, 0.78	0.001	0.036
Antenatal visits																	
None	35.4	1.00	Ref.		27.2	1.00	Ref.		35.1	1.00	Ref.		27.8	1.00	Ref.		<0.001
1–3	37.7	1.35	0.93, 1.95	0.110	36.5	1.01	0.73, 1.40	0.944	39.6	0.87	0.74, 1.03	0.115	35.9	1.16	1.00, 1.35	0.055	0.394
4+	40.6	1.69	1.29, 2.21	0.001	32.1	1.02	0.78, 1.34	0.862	39.9	0.95	0.84, 1.08	0.457	37.5	1.43	1.27, 1.62	<0.001	0.670
Delivery assistance																	
Health professionals	39.5	1.00	Ref.		38.1	1.00	Ref.		43.9	1.00	Ref.		40.6	1.00	Ref.		0.561
Traditional birth attendants	38.0	0.72	0.52, 1.00	0.05	30.3	0.79	0.55, 1.13	0.189	36.1	0.79	0.68, 0.92	0.003	31.9	0.71	0.62, 0.82	<0.001	0.088
Untrained personnel	37.3	0.75	0.57, 0.98	0.03	26.3	0.70	0.54, 0.91	0.007	33.9	0.78	0.68, 0.89	<0.001	28.7	0.65	0.58, 0.73	<0.001	0.336

Ref., reference category. % = proportion of mothers who engaged in early initiation of breast-feeding in the study population (0–23 months); P for interaction = interaction between a given study variable and the study period (1999–2013). Multivariable models adjusted for the potential confounding factors of geopolitical region, maternal age, birth interval and sex of the baby. In models of health service factors, additional adjustment was made for socio-economic status and individual factors. For models of individual factors, additional adjustment was made for socio-economic status and health service factors as confounders of the association between individual factors and breast-feeding indicators.

**Table 2** Exclusive breast-feeding by socio-economic, health service and individual characteristics, Nigeria, 1999–2013

Characteristic	1999					2003					2008					2013					P for interaction			
	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P				
<b>Socio-economic</b>																								
Mother's employment																								
Not working	14.5	1.00	Ref.		14.2	1.00	Ref.		12.0	1.00	Ref.		16.4	1.00	Ref.		16.4	1.00	Ref.		0.001	0.176		
Working	17.6	0.89	0.46, 1.71	0.715	18.2	0.72	0.41, 1.28	0.268	14.6	1.04	0.79, 1.37	0.793	18.2	0.79	0.62, 1.01	0.065	18.2	0.79	0.62, 1.01	0.065	0.045	0.045		
Mother's education																								
No education	8.3	1.00	Ref.		10.6	1.00	Ref.		6.8	1.00	Ref.		7.1	1.00	Ref.		7.1	1.00	Ref.		0.650	0.002		
Primary education	19.8	3.47	1.49, 8.06	0.004	10.8	0.69	0.31, 1.52	0.359	11.5	1.46	0.99, 2.16	0.056	20.0	2.27	1.57, 3.29	<0.001	20.0	2.27	1.57, 3.29	<0.001	0.043	0.043		
Secondary and above education	25.9	5.32	2.27, 12.45	0.001	24.7	2.22	1.07, 4.62	0.033	19.7	2.51	1.70, 3.71	0.001	31.1	3.15	2.20, 4.52	<0.001	31.1	3.15	2.20, 4.52	<0.001	0.111	0.111		
Father's education																								
No education	7.8	1.00	Ref.		10.6	1.00	Ref.		6.8	1.00	Ref.		6.2	1.00	Ref.		6.2	1.00	Ref.		0.995	0.018		
Primary education	17.5	2.35	0.95, 5.78	0.064	10.7	0.74	0.32, 1.70	0.472	11.5	1.20	0.78, 1.85	0.396	17.8	2.49	1.63, 3.79	<0.001	17.8	2.49	1.63, 3.79	<0.001	0.038	0.038		
Secondary and above education	24.2	4.29	1.84, 10.00	0.001	24.7	2.34	1.14, 4.79	0.020	19.7	2.14	1.47, 3.12	0.001	27.4	3.12	2.14, 4.56	<0.001	27.4	3.12	2.14, 4.56	<0.001	0.048	0.048		
Household poverty index																								
Poor	11.0	1.00	Ref.		10.5	1.00	Ref.		9.3	1.00	Ref.		8.9	1.00	Ref.		8.9	1.00	Ref.		0.692	0.189		
Middle	19.3	1.42	0.72, 2.81	0.307	20.4	1.71	0.91, 3.23	0.095	11.8	1.18	0.83, 1.68	0.359	18.5	2.10	1.52, 2.91	<0.001	18.5	2.10	1.52, 2.91	<0.001	0.022	0.022		
Rich	22.3	1.77	0.71, 4.45	0.222	21.0	2.81	1.26, 6.28	0.012	21.3	1.98	1.30, 3.01	0.001	33.3	3.07	2.04, 4.62	<0.001	33.3	3.07	2.04, 4.62	<0.001	0.043	0.043		
<b>Health service</b>																								
Place of delivery																								
Home	8.6	1.00	Ref.		12.5	1.00	Ref.		9.1	1.00	Ref.		10.2	1.00	Ref.		10.2	1.00	Ref.		0.068	0.001		
Health facility	27.3	4.09	2.01, 8.35	0.001	25.0	1.53	0.81, 2.89	0.192	20.6	1.87	1.38, 2.53	0.001	30.1	2.05	1.56, 2.68	<0.001	30.1	2.05	1.56, 2.68	<0.001	0.024	0.024		
Mode and place of delivery																								
Home	9.1	1.00	Ref.		12.5	1.00	Ref.		9.1	1.00	Ref.		10.2	1.00	Ref.		10.2	1.00	Ref.		0.098	0.005		
Health facility without caesarean	28.5	3.99	1.95, 8.16	0.001	23.8	1.40	0.72, 2.71	0.323	20.2	1.85	1.36, 2.51	0.001	30.4	2.10	1.60, 2.76	<0.001	30.4	2.10	1.60, 2.76	<0.001	0.015	0.015		
Health facility with caesarean	17.5	2.17	0.31, 15.07	0.433	26.7	4.03	0.53, 30.58	0.177	27.0	2.24	0.97, 5.18	0.058	29.6	1.77	0.90, 3.49	0.099	29.6	1.77	0.90, 3.49	0.099	0.976	0.976		
Antenatal visits																								
None	8.4	1.00	Ref.		7.3	1.00	Ref.		9.1	1.00	Ref.		8.9	1.00	Ref.		8.9	1.00	Ref.		0.389	0.002		
1–3	24.0	4.46	1.62, 12.27	0.004	19.8	3.41	1.40, 8.31	0.007	11.2	1.25	0.81, 1.94	0.316	12.5	1.34	0.89, 2.03	0.163	12.5	1.34	0.89, 2.03	0.163	0.262	0.262		
4+	20.6	2.72	1.24, 5.98	0.013	23.5	2.75	1.30, 5.84	0.008	18.4	1.62	1.18, 2.24	0.003	25.1	2.00	1.45, 2.77	<0.001	25.1	2.00	1.45, 2.77	<0.001	0.002	0.002		
Delivery assistance																								
Health professionals	27.1	1.00	Ref.		23.0	1.00	Ref.		19.6	1.00	Ref.		30.2	1.00	Ref.		30.2	1.00	Ref.		0.006	0.001		
Traditional birth attendants	4.9	0.13	0.04, 0.39	0.001	12.8	0.73	0.3, 1.76	0.479	7.1	0.50	0.32, 0.76	0.001	8.3	0.33	0.22, 0.49	<0.001	8.3	0.33	0.22, 0.49	<0.001	0.566	0.566		
Untrained personnel	10.6	0.23	0.11, 0.52	0.001	13.2	0.73	0.4, 1.38	0.330	11.6	0.69	0.51, 0.95	0.023	10.7	0.48	0.36, 0.64	<0.001	10.7	0.48	0.36, 0.64	<0.001	0.331	0.331		
<b>Individual</b>																								
Child's age (months)																								
0–1	25.4	1.00	Ref.		26.1	1.00	Ref.		20.2	1.00	Ref.		26.1	1.00	Ref.		26.1	1.00	Ref.		0.329	0.895		
2–3	15.0	0.47	0.24, 0.93	0.029	18.6	0.50	0.26, 0.96	0.037	14.4	0.64	0.47, 0.86	0	19.0	0.58	0.44, 0.77	<0.001	19.0	0.58	0.44, 0.77	<0.001	0.012	0.012		
4–5	8.2	0.26	0.13, 0.55	<0.001	7.1	0.15	0.07, 0.33	<0.001	8.0	0.26	0.19, 0.37	<0.001	10.0	0.21	0.16, 0.30	<0.001	10.0	0.21	0.16, 0.30	<0.001	0.128	0.128		

Ref., reference category. % = proportion of mothers who exclusively breast-feed in the study population (0–5 months); P for interaction = interaction between a given study variable and the study period (1999–2013). Multivariable models adjusted for the potential confounding factors of geopolitical region, maternal age, birth interval and sex of the baby. In models of health service factors, additional adjustment was made for socio-economic status and individual factors. For models of individual factors, additional adjustment was made for socio-economic status and health service factors as confounders of the association between individual factors and breast-feeding indicators.

### **Predominant breast-feeding**

The prevalence of predominant breast-feeding increased significantly among all mothers, irrespective of educational status, over the study period but was slightly lower in year 2008 for mothers with no schooling and mothers with primary level of education (Fig. 1(c)). Similar significant increasing trends were evident in mothers from all households and women who either had health service contact or not – particularly ANC visits and place of delivery (Table 3). Educated women and mothers from wealthier households were less likely to predominantly breast-feed their babies compared with women with no schooling and mothers from poorer households, respectively (Table 3). Similarly, mothers who made more than four ANC visits were less likely to predominantly breast-feed their babies compared with mothers who made no visits. Mothers who received delivery assistance from a non-health professional were significantly more likely to predominantly breast-feed their babies compared with mothers who delivered with the assistance of a health professional.

### **Bottle-feeding**

The results showed a minimal increasing prevalence of educated mothers who bottle-fed their babies over the four time points, with some variability in the intervening years, compared with mothers with no schooling (Fig. 1(d)). A similar increasing trend was observed in mothers from wealthier households compared with mothers from poorer households (Table 4). Mothers who made more than four ANC visits were significantly more likely to bottle-feed their babies compared with mothers who had no antenatal visit (Table 4). Similarly, the odds for bottle-feeding were significantly higher for women who delivered vaginally at the health facility compared with women who delivered at home. Educated mothers and mothers from wealthier households were significantly more likely to bottle-feed their babies compared with mothers without schooling and mothers from poor households.

### **Discussion**

The prevalence of EBF increased among educated mothers, women who had greater contact with health services and mothers from wealthier households over the study period (but with some variability in intervening years). However, there was an increasing prevalence for predominant breast-feeding and bottle-feeding among educated mothers compared with mothers with no schooling. The proportion of early initiation of breast-feeding decreased over the four time points but with a slight increase in the intervening year among women with no schooling and unemployed mothers, and among women from poorer households including mothers who had no health service contacts. Mothers from high SES groups and women who reported frequent health service

contacts had better feeding behaviours compared with mothers from low SES groups and women who had no health service contacts. Increasing child age was associated with non-EBF, predominant breast-feeding and bottle-feeding.

A number of methodological considerations need to be taken into account in the interpretation of these findings. First, breast-feeding outcomes were based on self-report and this is a potential source of measurement bias whereby mothers may inaccurately recall how and when the child was fed during the periods referred to by the survey questions. Likewise, misclassification in key study variables may also have occurred, for example under- or overestimation of the number of health service visits. Selection bias is less likely to affect the observed results due to the nationally representative sampling and high response rate of the surveys. Selected samples were drawn from the 1999 and 2006 national census frame, yielding response rates between 92 and 98 % without significant differences between urban and rural areas.

The analysis showed that mothers from wealthier households and women with higher educational achievement exclusively breast-feed their babies compared with mothers from poorer households and women with no schooling, respectively, perhaps reflecting that mothers from higher SES groups are more likely to access and respond to health messages at a health facility<sup>(36)</sup> compared with mothers from lower SES groups. A previous study found that primary education is the minimum level required to gain from health promotion messages and it empowers vulnerable populations – especially women – to act on health messages<sup>(37)</sup>. Previous studies from Nigeria and Ghana are consistent with this finding, where women from poorer households with no educational achievement engaged in suboptimal feeding practices compared with women from wealthier households with higher educational achievement<sup>(35,38)</sup>.

Employment was not associated with EBF in the present study; however, studies from regional Nigeria found that more than half (60–85 %) of female practising medical doctors engaged in suboptimal feeding practices due to pressure to resume work<sup>(39,40)</sup>. Aspects of specific work roles for women may be an explanation for the observed trend in feeding behaviours among higher SES mothers in Nigeria. Changes in female labour-force participation associated with socio-economic development in Nigeria may also be an additional factor associated with IYCF practices. Studies in Nigeria have also suggested a range of reasons why women do not exclusively breast-feed, including that EBF was very stressful<sup>(41)</sup>, a perceived notion that the child continued to be hungry after breast-feeding<sup>(42,43)</sup>, a lack of family support<sup>(41,42)</sup>, the existence of workplace barriers<sup>(39,44)</sup> and the increasingly prominent marketing practices of infant food manufacturers<sup>(45)</sup>. A response to the low prevalence of EBF in Nigeria has been a recent regional government initiative that introduced 10 d paid paternity leave for male public servants and

**Table 3** Predominant breast-feeding by socio-economic, health service and individual characteristics, Nigeria 1999–2013

Characteristic	1999					2003					2013					P for interaction	
	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI		P
<b>Socio-economic</b>																	
Mother's employment																	
Not working	45.4	1.00	Ref.		56.7	1.00	Ref.		50.5	1.00	Ref.		52.6	1.00	Ref.		0.839
Working	30.3	0.75	0.49, 1.16	0.194	47.3	0.73	0.49, 1.07	0.109	46.1	0.94	0.77, 1.13	0.489	51.2	1.11	0.93, 1.33	0.262	<0.001
Mother's education																	
No education	48.0	1.00	Ref.		63.1	1.00	Ref.		55.9	1.00	Ref.		61.6	1.00	Ref.		0.234
Primary education	33.2	0.86	0.52, 1.44	0.568	51.0	0.84	0.52, 1.38	0.500	45.1	1.18	0.90, 1.53	0.226	49.2	0.85	0.65, 1.10	0.219	0.012
Secondary and above education	26.7	0.59	0.34, 1.00	0.049	29.8	0.49	0.29, 0.82	0.007	39.8	1.00	0.75, 1.32	0.977	38.7	0.68	0.52, 0.89	0.005	0.006
Father's education																	
No education	51.1	1.00	Ref.		64.5	1.00	Ref.		55.6	1.00	Ref.		61.1	1.00	Ref.		0.680
Primary education	32.8	0.74	0.43, 1.25	0.256	47.6	0.73	0.44, 1.20	0.211	49.0	1.16	0.88, 1.51	0.296	51.0	0.96	0.73, 1.27	0.801	0.015
Secondary and above education	29.2	0.56	0.35, 0.91	0.019	41.7	0.56	0.35, 0.89	0.014	42.2	0.94	0.73, 1.21	0.641	44.7	0.90	0.70, 1.15	0.413	0.001
Household poverty index																	
Poor	45.1	1.00	Ref.		63.0	1.00	Ref.		53.1	1.00	Ref.		58.9		Ref.		0.091
Middle	32.4	0.72	0.47, 1.08	0.115	48.2	0.62	0.42, 0.92	0.019	47.8	0.94	0.75, 1.18	0.598	51.2	0.81	0.66, 0.99	0.041	0.004
Rich	35.1	0.91	0.50, 1.66	0.759	30.8	0.46	0.26, 0.84	0.011	42.6	0.89	0.66, 1.21	0.455	37.2	0.70	0.52, 0.94	0.016	0.146
<b>Health service</b>																	
Place of delivery																	
Home	45.7	1.00	Ref.		58.9	1.00	Ref.		52.1	1.00	Ref.		59.0	1.00	Ref.		0.068
Health facility	28.0	0.65	0.41, 1.03	0.068	34.8	0.62	0.39, 0.97	0.036	41.5	1.01	0.81, 1.27	0.931	39.1	0.68	0.55, 0.84	<0.001	0.024
Mode and place of delivery																	
Home	46.9	1.00	Ref.		58.9	1.00	Ref.		52.1	1.00	Ref.		73.2	1.00	Ref.		0.036
Health facility without caesarean	27.0	0.57	0.36, 0.92	0.020	37.6	0.68	0.43, 1.08	0.102	41.4	1.01	0.81, 1.27	0.916	25.8	0.70	0.56, 0.86	0.001	0.040
Health facility with caesarean	37.4	1.28	0.34, 4.84	0.714	0.0	0.00	0.00, 0.00	0.994	45.1	1.34	0.64, 2.78	0.437	1.0	0.34	0.18, 0.66	0.001	0.852
Antenatal visits																	
None	47.3	1.00	Ref.		63.2	1.00	Ref.		54.7	1.00	Ref.		59.1	1.00	Ref.		0.148
1–3	32.3	0.57	0.30, 1.09	0.090	53.2	0.73	0.41, 1.30	0.283	43.1	0.70	0.52, 0.94	0.019	58.0	0.87	0.66, 1.14	0.316	0.032
4+	33.1	0.56	0.37, 0.87	0.010	40.3	0.43	0.27, 0.69	<0.001	42.8	0.77	0.61, 0.96	0.023	44.5	0.69	0.55, 0.86	0.001	0.010
Delivery assistance																	
Health professionals	28.5	1.00	Ref.		37.3	1.00	Ref.		42.6	1.00	Ref.		40.2	1.00	Ref.		0.006
Traditional birth attendants	52.9	1.90	1.08, 3.36	0.027	55.8	1.40	0.78, 2.50	0.261	50.9	0.99	0.75, 1.31	0.942	56.9	1.34	1.03, 1.73	0.028	0.566
Untrained personnel	41.8	1.26	0.78, 2.05	0.348	59.3	1.59	1.01, 2.50	0.044	51.1	0.91	0.72, 1.15	0.439	59.4	1.49	1.20, 1.86	<0.001	0.331
<b>Individual</b>																	
Child's age (months)																	
0–1	43.6	1.00	Ref.		55.0	1.00	Ref.		56.4	1.00	Ref.		59.8	1.00	Ref.		0.012
2–3	42.6	0.86	0.54, 1.36	0.510	57.3	0.91	0.57, 1.44	0.680	48.6	0.73	0.58, 0.91	0.006	55.5	0.82	0.66, 1.02	0.072	0.078
4–5	30.7	0.45	0.27, 0.73	0.001	43.5	0.50	0.32, 0.80	<0.001	41.9	0.48	0.39, 0.60	<0.001	42.8	0.44	0.35, 0.55	<0.001	0.120

Ref., reference category. % = proportion of mothers who predominantly breast-feed in the study population (0–5 months); P for interaction = interaction between a given study variable and the study period (1999–2013). Multivariable models adjusted for the potential confounding factors of geopolitical region, maternal age, birth interval and sex of the baby. In models of health service factors, additional adjustment was made for socio-economic status and individual factor. For models of individual factors, additional adjustment was made for socio-economic status and health service factors as confounders of the association between individual factors and breast-feeding indicators.



**Table 4** Bottle-feeding by socio-economic, health service and individual characteristics, Nigeria 1999–2013

Characteristic	1999					2003					2008					2013					P for interaction			
	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P	%	OR	95% CI	P				
<b>Socio-economic</b>																								
<b>Mother's employment</b>																								
Not working	9.5	1.00	Ref.		14.1	1.00	Ref.		9.9	1.00	Ref.		12.4	1.00	Ref.		12.4	1.00	Ref.			0.126		
Working	14.9	0.98	0.71, 1.35	0.907	14.8	1.06	0.79, 1.41	0.701	12.0	0.96	0.83, 1.12	0.625	12.8	0.87	0.76, 0.99	0.035	12.8	0.87	0.76, 0.99	0.035		0.120		
<b>Mother's education</b>																								
No education	7.9	1.00	Ref.		10.2	1.00	Ref.		4.4	1.00	Ref.		7.0	1.00	Ref.		7.0	1.00	Ref.			0.007		
Primary education	12.7	1.08	0.72, 1.62	0.707	15.0	1.10	0.76, 1.59	0.625	13.4	1.60	1.09, 2.33	0.016	14.4	1.56	1.09, 2.25	0.016	14.4	1.56	1.09, 2.25	0.016		0.352		
Secondary and above education	18.9	1.62	1.09, 2.39	0.016	22.3	1.56	1.07, 2.28	0.021	19.2	2.41	1.65, 3.53	0.001	19.6	1.93	1.34, 2.77	<0.001	19.6	1.93	1.34, 2.77	<0.001		0.219		
<b>Father's education</b>																								
No education	8.6	1.00	Ref.		10.3	1.00	Ref.		3.7	1.00	Ref.		6.1	1.00	Ref.		6.1	1.00	Ref.			0.004		
Primary education	12.0	0.90	0.60, 1.36	0.616	14.4	1.21	0.82, 1.78	0.332	12.5	1.89	1.49, 2.40	0.001	14.4	1.39	1.12, 1.72	0.003	14.4	1.39	1.12, 1.72	0.003		0.149		
Secondary and above education	15.9	1.23	0.85, 1.77	0.274	17.4	1.38	0.96, 1.99	0.080	17.0	2.41	1.93, 3.00	0.001	17.2	1.73	1.42, 2.11	<0.001	17.2	1.73	1.42, 2.11	<0.001		0.063		
<b>Household poverty index</b>																								
Poor	8.3	1.00	Ref.		10.9	1.00	Ref.		6.1	1.00	Ref.		8.3	1.00	Ref.		8.3	1.00	Ref.			0.011		
Middle	15.6	1.66	1.21, 2.27	0.002	15.7	1.60	1.16, 2.20	0.004	11.1	1.62	1.33, 1.98	0.001	13.4	1.31	1.11, 1.54	0.001	13.4	1.31	1.11, 1.54	0.001		0.386		
Rich	14.7	1.20	0.78, 1.85	0.401	21.0	1.63	1.07, 2.47	0.023	16.5	1.84	1.46, 2.33	0.001	20.0	1.58	1.28, 1.95	<0.001	20.0	1.58	1.28, 1.95	<0.001		0.001		
<b>Health service</b>																								
<b>Place of delivery</b>																								
Home	9.1	1.00	Ref.		11.6	1.00	Ref.		7.3	1.00	Ref.		8.9	1.00	Ref.		8.9	1.00	Ref.			0.009		
Health facility	17.1	1.34	0.99, 1.84	0.062	20.2	1.08	0.79, 1.49	0.615	18.1	1.64	1.39, 1.94	0.001	18.9	1.46	1.25, 1.69	<0.001	18.9	1.46	1.25, 1.69	<0.001		0.006		
<b>Mode and place of delivery</b>																								
Home	8.7	1.00	Ref.		11.6	1.00	Ref.		7.3	1.00	Ref.		8.9	1.00	Ref.		8.9	1.00	Ref.			0.003		
Health facility without caesarean	17.3	1.44	1.05, 1.98	0.023	18.9	1.03	0.74, 1.42	0.867	17.5	1.60	1.35, 1.89	0.001	18.7	1.42	1.22, 1.66	<0.001	18.7	1.42	1.22, 1.66	<0.001		0.033		
Health facility with caesarean	13.6	1.07	0.48, 2.39	0.874	33.0	2.80	1.18, 6.65	0.019	28.8	2.50	1.65, 3.80	0.001	26.1	2.26	1.61, 3.16	<0.001	26.1	2.26	1.61, 3.16	<0.001		0.473		
<b>Antenatal visits</b>																								
None	8.3	1.00	Ref.		9.1	1.00	Ref.		6.0	1.00	Ref.		7.4	1.00	Ref.		7.4	1.00	Ref.			0.053		
1–3	14.4	1.62	1.03, 2.57	0.038	16.9	1.56	1.01, 2.41	0.046	11.9	1.66	1.30, 2.10	0.001	13.0	1.39	1.12, 1.73	0.003	13.0	1.39	1.12, 1.73	0.003		0.827		
4+	14.6	1.29	0.92, 1.81	0.141	17.9	1.74	1.21, 2.50	0.003	16.3	1.86	1.56, 2.22	0.001	16.2	1.47	1.24, 1.74	<0.001	16.2	1.47	1.24, 1.74	<0.001		0.081		
<b>Delivery assistance</b>																								
Health professionals	16.7	1.00	Ref.		19.4	1.00	Ref.		18.3	1.00	Ref.		18.7	1.00	Ref.		18.7	1.00	Ref.			0.003		
Traditional birth attendants	9.3	0.82	0.54, 1.25	0.352	11.8	0.97	0.63, 1.51	0.906	8.0	0.55	0.44, 0.69	0.001	8.3	0.60	0.49, 0.73	<0.001	8.3	0.60	0.49, 0.73	<0.001		0.497		
Untrained personnel	9.1	0.76	0.54, 1.06	0.102	12.0	1.01	0.73, 1.40	0.936	7.5	0.65	0.54, 0.77	0.001	9.4	0.76	0.64, 0.89	0.001	9.4	0.76	0.64, 0.89	0.001		0.025		
<b>Individual</b>																								
<b>Child's age (months)</b>																								
0–5	17.7	1.00	Ref.		21.4	1.00	Ref.		15.3	1.00	Ref.		15.6	1.00	Ref.		15.6	1.00	Ref.			0.591		
6–11	15.0	0.72	0.51, 1.03	0.069	15.7	0.75	0.55, 1.03	0.077	13.4	0.90	0.76, 1.07	0.231	16.4	1.00	0.86, 1.16	0.998	16.4	1.00	0.86, 1.16	0.998		0.002		
12–23	7.9	0.37	0.27, 0.52	<0.001	8.9	0.35	0.25, 0.48	<0.001	7.3	0.46	0.39, 0.54	<0.001	9.0	0.46	0.39, 0.53	<0.001	9.0	0.46	0.39, 0.53	<0.001		0.008		

Ref., reference category. % = proportion of mothers who bottle-fed in the study population (0–23 months); P for interaction = interaction between a given study variable and the study period (1999–2013). Multivariable models adjusted for the potential confounding factors of geopolitical region, maternal age, birth interval and sex of the baby. In models of health service factors, additional adjustment was made for socio-economic status and individual factors. For models of individual factors, additional adjustment was made for socio-economic status and health service factors as confounders of the association between individual factors and breast-feeding indicators.

extended paid maternity leave for female public officers from 3 to 6 months, with the promotion of EBF being part of the rationale for this initiative<sup>(46)</sup>. Previous studies in Nigeria and Tanzania found that mothers of higher educational achievement were more likely to engage in EBF compared with mothers with no schooling<sup>(27,35,47)</sup>.

In comparing Nigeria with other African countries (such as South Africa) with a significant resource-based economy and a growing middle class<sup>(48)</sup> including low breast-feeding indices<sup>(49)</sup>, a randomized controlled trial in South Africa found that antenatal intention not to breast-feed and mothers with a personal income had increased risk of poor feeding practices compared with mothers without personal income<sup>(50)</sup>. Studies from South Africa also suggested that the fear of maternal-to-child transmission of HIV has been responsible for the poor feeding behaviours reported in South Africa<sup>(50)</sup>; however, most South African studies found that the risk of HIV transmission was lower among exclusively breast-fed infants compared with infants who received mixed feeding<sup>(51,52)</sup>.

Information received during health service contacts – more likely to be accessed by higher SES women<sup>(36,53–55)</sup> – may also be an important driver of trends in optimal feeding practices. A previous Nigerian study found that mothers who had more contact with health services received information on optimal feeding practices<sup>(33)</sup>. Similarly, the analysis found that mothers who had greater access to health services exclusively breast-fed their babies compared with mothers who had no health service access, suggesting that mothers may have received appropriate information on feeding practices during antenatal, partum and postnatal periods. Studies from Nigeria found that nursing mothers have good knowledge and positive attitude towards breast-feeding<sup>(19,56,57)</sup> and that women with greater access to a health facility were more likely to receive and respond to health promotion messages<sup>(58)</sup>. A review of a regional Nigerian government initiative (free maternal and child health services) found an increase in health service access among women and better maternal and child health outcomes<sup>(59,60)</sup>. Accordingly, to improve feeding practices in Nigerian women, sub-national (states and local councils) intervention programmes that would ensure better health service access to mothers from lower SES groups is proposed as an adjunct to the full implementation and sustainability of the Millennium Development Goals project.

Early initiation of breast-feeding is important for providing newborns with immunity to resist respiratory and gastrointestinal diseases<sup>(61,62)</sup>. In the current study, mothers who had more than four ANC visits and those who delivered at the health facility more often initiated breast-feeding within the first hour of birth compared with mothers who had no ANC visit and those who delivered at home. This suggests that mothers who had greater health service contacts may have received adequate health information about optimal feeding

behaviours, acknowledging that health service contacts – especially ANC visits – offer an important opportunity for communicating health promotion messages. Studies in developed countries like Australia<sup>(63)</sup> and the USA<sup>(64)</sup> found the prevalence of early initiation of breast-feeding to be at least 90%, signifying that the Baby-Friendly Hospital Initiative can operate very well in the context of early initiation of breast-feeding. However, similar studies in Nigeria found the prevalence of early initiation of breast-feeding to be very low (33–38%)<sup>(13,18)</sup> and that mothers who delivered vaginally at home or by caesarean section at a health facility were more likely to delay initiation of breast-feeding compared with mothers who delivered vaginally at a health facility<sup>(12)</sup>. Similarly, studies from Ghana and an international review found that delivering by caesarean section remains a significant impediment to early initiation of breast-feeding especially in developing countries. Most deliveries occur at home in Nigeria<sup>(13,17)</sup>, and this may be a reason for the low prevalence of early initiation of breast-feeding. A response to this observed deficit was the Baby-Friendly Community Initiative proposed by WHO/UNICEF to promote, protect and support optimal feeding practices at the community level, which has been shown to be successful elsewhere<sup>(5)</sup>.

The present analysis found that educated mothers and mothers from wealthier households were significantly more likely to bottle-feed their babies compared with mothers with no schooling and mothers from poor households, suggesting that mothers of higher SES are more likely to have the material resources to purchase formula feeds. In Nigeria, poor national policies, prominent marketing practices of breast-milk substitutes and ignorance of the risks of bottle-feeding by nursing mothers have been identified as determinants for the increasing trend of bottle-feeding<sup>(45)</sup>, as well as work environments that do not support breast-feeding mothers<sup>(39)</sup>. An international literature review found that working mothers in developing countries like Nigeria usually turn to breast-milk substitutes for feeding of their newborn<sup>(65)</sup> and this may be another factor driving the increase trend in bottle-feeding among women of higher SES in Nigeria. Studies in Ghana have similar findings, where mothers of higher SES were more likely to use breast-milk substitute compared with mothers of lower SES<sup>(38,66)</sup>.

Nigerian data from the Millennium Development Goals performance tracking survey showed social complexities that indicate breast-feeding promotion needs to be context specific<sup>(67)</sup>. Nigeria is the most populous country and largest economy in Africa, sharing a growing middle class and significant resource-based economy with other African countries (such as South Africa and Ghana)<sup>(48,68,69)</sup>, and the feeding practices observed in Nigeria could be extrapolated to similar African countries. Findings from the present study suggest that high SES women engaged in EBF and early initiation of breast-feeding compared with low SES women; however, mothers in high SES groups

also significantly engaged in predominant breast-feeding and bottle-feeding, suggesting that the duration of EBF practised by many high SES women was suboptimal. This finding has previously been reported in Nigerian and Brazilian studies where high SES women engaged in suboptimal EBF, due largely to pressure to resume work postnatally, compared with low SES women<sup>(35,70)</sup>. Further, lower SES mothers and women who reported no health service contacts had poorer feeding practices. Studies have shown that poorly breast-fed children have an increased risk of developing obesity<sup>(71)</sup>, asthma<sup>(72)</sup>, allergic conditions<sup>(72)</sup> and type 1 diabetes<sup>(73)</sup>; and women reporting not to breast-feed are more likely to develop ovarian cancer<sup>(74,75)</sup>, rheumatoid arthritis<sup>(76,77)</sup> and type 2 diabetes<sup>(78)</sup>. National, state and local council intervention policies and programmes are needed to improve the current feeding practices in Nigeria and should target all mothers regardless of SES.

## Conclusion

The present study found a significant increasing trend in EBF and early initiation of breast-feeding among mothers of higher SES and mothers who had a higher frequency of health service access. However, nursing mothers of higher SES groups and mothers who reported more frequent health service use also engaged in predominant breast-feeding and bottle-feeding practices. Mothers from lower SES groups and women who made no health service contacts delayed initiation of breast-feeding and engaged in non-EBF compared with mothers from high SES groups and women who made health service contacts.

National policies that underpin IYCF practices in the workplace and consider the extent and appropriateness of advertising by infant food manufacturers are perhaps responses to address these factors affecting optimal feeding practices in Nigeria. Additionally, sub-national (state and local government council) programmes and facility-based programmes that promote the baby-friendly hospital initiatives for families and health-care professionals, including broader community-based interventions (such as baby-friendly community initiatives) for non-health professionals who support nursing mothers in the communities, are also recommended as adjuncts to improve IYCF practices among Nigerian mothers.

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