Breast-, complementary and bottle-feeding practices in Kenya: stagnant trends were experienced from 1998 to 2009

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ABSTRACT

The pattern of infant and young child feeding that provides the most benefit includes being put to the breast within an hour of birth, exclusive breastfeeding for 6 months, continued breastfeeding along with complementary foods up to 2 years of age or beyond, and avoidance of any bottle-feeding. However, since there are no published data from Kenya regarding trends in these feeding practices, this research undertook time trend estimation of these feeding practices using the 1998, 2003, and 2008-2009 Kenya Demographic and Health Survey and also examined the multivariate relationships between sociodemographic factors and feeding practices with data from 2008 to 2009. Logistic regression was used to test the significance of trends and to analyze sociodemographic characteristics associated with feeding practices. There was a significant decline in early initiation of breastfeeding among children in Central and Western provinces and those residing in urban areas. Trends in exclusive breastfeeding showed significant improvement in most sociodemographic segments, whereas trends in complementary feeding and breastfeeding remained stable. Bottle-feeding significantly decreased among children aged 12 to 23 months, as well as those living in Coast, Eastern, and Rift Valley provinces. In the multivariate analysis, the province was significantly associated with feeding practices, after controlling for child's size, birth order, and parity. The stagnant (and in some cases worsening) trends in early initiation of breastfeeding and complementary feeding with breastfeeding paint a worrisome picture of breastfeeding practices in Kenya; therefore, efforts to promote the most beneficial feeding practices should be intensified.

1. Introduction

Over the years, the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) have recognized breastfeeding as the most cost-effective, health-promoting, and disease-preventing strategy across the globe [1,2]. Given the overwhelming evidence of the importance of breastfeeding in reducing child mortality and morbidity, especially in developing countries, breastfeeding remains at the core of achieving millennium development goals 4 and 5 [3]. Unfortunately

though, 1.4 million child deaths and a further 44 million disability-adjusted life years experienced in low-income and middle-income countries are attributable to suboptimal breastfeeding [4].

The benefits of breastfeeding to the health and development of the child as well as the mother have been well documented [5–9]. Research reviews have highlighted various physical, motor, cognitive, and psychosocial advantages that breast milk offers to the child [7,9]. Breast milk boosts a child's immune system through protection from infection, it is a protective factor against obesity and other adult diseases such as diabetes and hypertension, and it saves money that might be used in buying breast milk substitutes. High child malnutrition rates and poor living environments characterized by unhygienic conditions and contaminated drinking water are common in developing countries. These conditions increase the risk of child infection, thus exacerbating the negative effects of not breast-feeding [3,7,10]. Breastfeeding enhances the bond between the child and mother, a prerequisite for normal child development. Furthermore, breastfeeding mothers enjoy benefits such as reduced postpartum bleeding, early uterine involution, delayed resumption of the menstrual cycle (and hence birth spacing), reduced risks of breast and endometrial cancer, and lessened risk of bone remineralization (which in turn reduces the risk of hip fractures in older age).

The global strategy for infant and young children feeding provides the roadmap toward achieving optimal child feeding practices [2]. The Kenyan government has adopted this strategy, and breastfeeding is among 11 prioritized high-impact nutrition interventions for child survival and development [11]. Among other guidelines, it is recommended that the newborn has skin-to-skin contact with the mother and start breastfeeding within 1 hour after birth [12]. This practice helps in bonding the dyad, stimulates production of colostrum milk that has high immunological benefit to the child, and also aids contraction of the mother's womb for faster expulsion of the placenta and reduced risk of heavy bleeding. Children are expected to be exclusively breastfed for 6 months and, thereafter, receive adequate complementary foods with continued breastfeeding for 2 years or beyond. Feeding a child using a bottle with a teat is highly discouraged because it endangers the baby's health and survival through contamination and interference with breastfeeding establishment [12].

Despite improvements in breastfeeding at the national level in developing countries, there are fears of decline in certain sociodemographic segments, especially among mothers in urban areas and of higher socioeconomic status [13,14]. It is also evident that breastfeeding practices in sub-Saharan Africa vary from country to country, and within countries [14,15]. Numerous cross-sectional studies have been undertaken on breastfeeding practices in Kenya [16–18], but long-term trends are not yet documented. To fill this gap, an aim of this study was to examine trends in early initiation of breastfeeding at 0 to 23 months of age, exclusive breastfeeding at 0 to 5 months of age, complementary feeding and breastfeeding at 6 to 23 months of age, and bottle-feeding at 0 to 23 months of age, using measures and definitions recommended by WHO [19]. To provide details at the levels of subgroups and subnational areas, the trends estimations were disaggregated by child's sex, child's age, province,

residence, maternal education, household wealth, maternal literacy, and media exposure.

A second aim was to examine multivariate relationships between sociodemographic factors and feeding practices with data from 2008 to 2009, the most recent available data. The health promotion conceptual model guiding this analysis is UNICEF's social-ecological model of child care, as further specified by Engle et al [20]. Child feeding practices are in focus in this analysis, as well as a critical part of a cluster of mother/child dyad care behaviors, including care for mother, child psychological and social stimulation, home hygiene practices, home health care practices, and food preparation and storage practices. To facilitate a manageable analysis, only the feeding practices "early initiation of breastfeeding," "exclusive breastfeeding the first 6 months," "complementary feeding and breastfeeding at 6 to 23 months," and "bottle feeding at 0 to 23 months" are included as endpoints. The relationships of these 4 feeding practices were examined with respect to 2 clusters of independent variables that are specified in the UNICEF model: resources for care (eg, maternal education) and contextual factors (eg, urban-rural setting). By specifying and focusing on resources for care, the analysis was guided by an unequivocal health promotion perspective, contra a disease promotion perspective, in which risk factors have a more prominent place than do protective factors.

2. Methods and materials

2.1. Data sources

The study used data from the Kenya Demographic and Health Survey (KDHS), which is publicly available [21]. The 1998, 2003, and 2008–2009 KDHS datasets used in this study are from nationally representative household surveys that collected data on maternal, paternal, and child demography, health, and nutrition. For each survey, the KDHS used a two-stage cluster sampling design whereby enumeration areas (clusters) were first drawn from a national master sample frame. Thereafter, a sample of households was drawn from the selected clusters using systematic sampling methods. Women aged 15 to 49 years and men aged 15 to 54 years from the sampled households were interviewed using specific questionnaires for women and men, following an enumeration of all household inhabitants. The interview questionnaires were based on model Demographic and Health Survey (DHS) questionnaires that underwent slight adjustments to reflect relevant issues in Kenya and conducted through a consultative process with technical institutions, government agencies, and local and international organizations. The number of households sampled were 8380 in 1998, 8561 in 2003, and 9057 in 2008 to 2009, with a response rate to the women's questionnaire (from which all the data used in this study were obtained) of greater than 96% in all surveys [22–24]. To enhance data quality, DHS conducted rigorous training for its data collection fieldworkers, and data management was closely supervised at all stages [25].

The 4 cross-sectional datasets from each survey year were merged into a single file to enable trend estimation. To compare the prevalence of breastfeeding practices, the study used identical questions asked across the 3 surveys. From

each household with a child aged 0 to 23 months, the data from the mother and her youngest child were used. The unweighted sample sizes were 2235 mother-child pairs in 1998, 2141 mother-child pairs in 2003, and 2125 mother-child pairs in 2008 to 2009.

2.2. Variables

Using the WHO recommendations for assessing infant and young child feeding practices [19], 2 core indicators (early initiation of breastfeeding and exclusive breastfeeding) and 2 optional indicators (age-appropriate breastfeeding and bottle-feeding) were measured. Early initiation of breastfeeding refers to the proportion of children aged 0 to 23 months who were reported by mothers to have been put to the breast within 1 hour after birth. Exclusive breastfeeding refers to the proportion of infants aged 0 to 5 months who were reported by mothers to have been fed exclusively with breast milk. Age-appropriate breastfeeding is based on mothers' reports and refers to feeding only on breast milk at ages 0 to 5 months and feeding on breast milk as well as solid, semisolid, or soft foods at ages 6 to 23 months (these 2 groups of children are presented independently in this analysis). Bottle-feeding refers to the proportion of children aged 0 to 23 months who were fed with a bottle for at least part of their feeding, also according to mothers' reports [19]. There is evidence that a mother's recall is a valid and reliable method of collecting data on feeding practices, including breastfeeding [26–28].

The analyses of trends in feeding over the 3 surveys were stratified by child's sex and age; province; residence (urban/rural); wealth quintile; and maternal education, literacy, newspaper reading, television watching, and radio listening. Child age categories were 0 to 11 and 12 to 23 months for early initiation of breastfeeding, and 0 to 5, 6 to 11, and 12 to 23 months for bottle-feeding [19]. Provincial stratification was restricted to 7 provinces: Nairobi, Central, Coast, Eastern, Nyanza, Rift Valley, and Western. The North-Eastern province was not included because data were not collected in this province during the 1998 survey. Stratification by wealth was by quintiles (richest, richer, middle, poorer, and poorest) constructed using household asset data through principal component analysis [29]. Other variables were categorized as shown in the Tables. Some information was lost in some of the categorization decisions, for example, maternal occupation, which we group in 3 categories. The standard DHS occupational classification uses 7 categories, which we collapsed into 3 categories because of very low numbers in some of the 7 categories.

2.3. Statistical analyses

Analyses were conducted using SPSS for Windows version 19. Logistic regression was used to test for linear trends (slope) in the prevalence of early initiation of breastfeeding, exclusive breastfeeding, complementary feeding and breastfeeding, and bottle-feeding. The regression equation:

$$\log(p/1-p) = \beta 0 + \beta \text{ survey year} \cdot \text{survey year}$$

was used to test the significance of the slope (the null hypothesis was that the regression coefficient β for survey year was not significantly different from zero).

To study associations between breastfeeding practices and sociodemographic variables in the most recent data available (2008–2009), bivariate analyses were conducted using either χ^2 or Student's t test, depending on a sociodemographic variable's level of measurement. Logistic regression was then used, including sociodemographic variables having significant bivariate associations ($P < .05$) with the feeding variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. Because of the multistage sampling design used in the collection of data, all analyses were weighted with DHS sample weights, and the sampling design (clusters and strata) was accounted for [25].

3. Results

Characteristic of the 3 samples are shown in Table 1.

3.1. Trends in early initiation of breastfeeding, exclusive breastfeeding, complementary feeding and breastfeeding, and bottle-feeding

In the text below, the F tests are from the regression analyses for linear trend. In the analyses of early initiation of breastfeeding, there was little change for either girls or boys over the course of the study (Table 2). There was great variability between provinces in each survey year and between survey years within provinces. Beside posting the

Table 1 – Sample distribution by survey year, feeding practices, and demographic characteristics

	KDHS 1998		KDHS 2003		KDHS 2008-09	
	%	n	%	n	%	n
Feeding practices						
Early initiation of beastfeeding	54.5	1073	48.7	997	54.9	1156
Exclusive breastfeeding	16.6	71	14.6	82	38.1	173
Complementary feeding and breastfeeding	81.9	1248	83.7	1288	78.8	1245
Bottle-feeding	22.3	446	22.4	468	19.7	427
Sex						
Male	55.0	1220	62.7	1334	62.8	1342
Female	45.0	1015	37.3	807	37.2	783
Age						
0-5 mo	23.9	525	26.2	566	24.0	533
6-11 mo	25.8	583	26.8	572	27.2	595
12-23 mo	50.2	1127	47.0	1003	48.8	997
Province						
Nairobi	7.2	86	6.1	190	5.8	160
Central	9.2	188	10.7	278	7.2	166
Coast	8.2	345	9.1	287	9.8	357
Eastern	16.2	296	16.4	278	15.4	300
Nyanza	20.8	370	15.4	288	20.1	432
Rift Valley	25.4	650	29.0	495	30.2	414
Western	12.9	300	13.2	325	11.5	296
Residence						
Urban	19.9	356	18.5	533	19.9	554
Rural	80.1	1879	81.5	1608	80.1	1571
Total		2235		2141		2125

lowest prevalence in all the survey years, the Western province also experienced a significant worsening trend ($F_{1,51}$ = 5.26, P < .023). Only Nyanza province recorded a significant improving trend ($F_{1,149}$ = 25.57, P < .000). There were limited changes in prevalence stratified by maternal education, maternal literacy, and maternal media exposure, with only children born to mothers who did not listen to the radio at least once a week posting a significant improving trend ($F_{1,663}$ = 4.50, P < .034).

Trends in exclusive breastfeeding mostly improved (Table 3). Girls and boys posted significant improving trends ($F_{1,772}$ = 11.16, P < .001) and ($F_{1,772}$ = 15.35, P < .000), respectively. In addition, children in rural areas posted significant improvement ($F_{1,596}$ = 27.15, P < .000). Comparing the richest versus the poorest groups, both quintiles posted significant improving trends, but the poorest performed better than the richest with its prevalence of exclusive breastfeeding tripling from 1998 to 2008-2009 ($F_{1,213}$ = 17.96, P < .000).

There were almost no statistically significant changes in prevalence across the study period in complementary feeding and breastfeeding (Table 4). Only children born to mothers who could read with difficulty posted a significant worsening trend ($F_{1,663}$ = 4.50, P < .034).

In the analyses of bottle-feeding (Table 5), the sociodemographic pattern had mostly stable trends and only 1 worsening trend in the Western province ($F_{1,151}$ = 4.54, P < .035). Statistically significant improving trends (declines in bottle-feeding) were observed among children aged 12 to 23

Table 2 – Trends in early initiation of breastfeeding (within 1 hour) for children aged 0-23 months								
	KDHS 1998		KDHS 2003		KDHS 2008-2009				
	%	95% CI	%	95% CI	%	95% CI	Grand n	P	Trend
Total	54.5	51.6-57.4	48.7	45.4-52.0	54.9	50.7-59.0	6253	.842	
Sex									
Female	53.5	49.8-57.2	52.2	48.1-56.3	53.9	48.5-59.3	2525	.924	
Male	55.4	51.6-59.1	46.6	42.9-50.2	55.5	50.9-60.0	3728	.783	
Age									
0-11 mo	54.5	50.7-58.2	47.7	43.8-51.5	53.9	49.3-58.3	3250	.909	
12-23 mo	54.6	50.7-58.4	49.8	45.8-53.9	56.0	50.3-61.5	3003	.671	
Province									
Nairobi	55.1	43.3-66.4	51.4	42.3-60.3	57.9	48.5-66.8	423	.745	
Central	69.3	61.7-76.0	59.6	53.3-65.7	46.3	39.0-53.7	621	.000	↘
Coast	45.4	37.7-53.2	18.9	12.0-28.4	31.8	21.6-44.0	934	.090	
Eastern	62.5	53.4-70.8	59.0	50.9-66.7	69.5	60.0-77.6	848	.261	
Nyanza	40.5	34.4-46.8	46.4	38.8-54.2	62.4	56.5-67.9	1055	.000	↗
Rift Valley	65.1	59.2-70.6	60.1	53.5-66.3	61.0	51.4-69.8	1492	.494	
Western	40.3	33.1-48.0	23.7	18.3-30.1	29.3	23.8-35.6	880	.023	↘
Residence									
Urban	59.5	52.9-65.7	46.4	40.7-52.2	45.6	37.3-54.2	1385	.012	↘
Rural	53.3	50.0-56.6	49.2	45.2-53.2	57.2	52.5-61.8	4868	.165	
Wealth index									
Richest	59.0	52.9-64.8	46.9	41.9-51.9	50.9	44.8-56.9	1280	.071	
Richer	60.4	54.5-66.1	53.4	47.6-59.1	55.2	45.8-64.3	1109	.370	
Middle	58.7	53.0-64.1	48.2	42.3-54.1	55.8	47.6-63.7	1146	.567	
Poorer	48.6	43.2-54.0	49.1	42.9-55.3	56.8	48.8-64.5	1256	.090	
Poorest	48.3	41.9-54.7	46.7	39.0-54.6	55.6	48.0-63.0	1462	.138	
Maternal education									
Secondary +	61.9	55.5-67.8	54.6	48.3-60.8	59.9	53.1-66.3	953	.696	
Incomplete secondary	45.5	37.2-54.1	47.0	39.1-55.1	53.5	43.3-63.4	566	.245	
Complete primary	55.6	50.3-60.7	50.1	45.9-54.4	59.2	52.3-65.7	1701	.334	
Incomplete primary	53.0	48.5-57.5	43.4	38.8-48.1	49.2	43.7-54.8	2228	.273	
No education	55.1	46.2-63.7	56.3	43.9-67.9	53.3	41.0-65.3	805	.804	
Maternal literacy									
Reads easily	53.0	49.7-56.4	47.5	44.3-50.7	55.1	50.5-59.7	4049	.385	
Reads with difficulty	56.4	50.5-62.2	50.3	41.4-59.1	60.2	51.8-68.1	923	.554	
Cannot read	57.0	49.7-64.0	51.8	43.4-60.1	48.4	39.3-57.6	1250	.145	
Mother reads newspaper									
Yes	55.7	51.4-60.0	46.2	42.4-50.1	52.9	47.5-58.2	2107	.511	
No	53.9	50.4-57.4	49.9	45.4-54.4	56.0	50.7-61.0	4134	.511	
Mother watches television									
Yes	57.1	51.4-62.7	48.8	44.4-53.3	52.7	47.1-58.2	1786	.445	
No	53.9	50.6-57.3	48.7	44.7-52.7	56.2	51.2-61.0	4447	.525	
Mother listens to radio									
Yes	57.0	53.6-60.3	57.0	53.6-60.3	47.3	44.2-50.4	4633	.645	
No	51.1	46.9-55.3	55.5	47.1-63.6	60.0	52.4-67.2	1610	.034	↗

Secondary +, complete secondary and/or higher education; ↘, significant decreasing trend; ↗, significant increasing trend based on logistic regression.

Table 3 – Trends in exclusive breastfeeding for children aged 0-5 months

	KDHS 1998		KDHS 2003		KDHS 2008-2009				
	%	95% CI	%	95% CI	%	95% CI	Grand nN	P	Trend
Total	16.6	13.0-21.0	14.6	11.4-18.4	38.1	32.0-44.7	1,558	.000	↗
Sex									
Female	15.9	10.8-22.8	9.6	6.0-15.1	38.7	28.5-49.9	565	.001	↗
Male	17.1	12.0-23.7	17.3	13.2-22.3	37.9	29.7-46.8	993	.000	↗
Residence									
Urban	12.9	6.6-23.6	13.5	8.2-21.4	24.8	16.9-34.9	357	.071	
Rural	17.4	13.4-22.4	14.8	11.3-19.3	40.7	33.7-48.1	1,201	.000	↗
Wealth index									
Richest	13.4	7.2-23.8	12.9	7.6-21.0	29.1	20.5-39.7	338	.026	↗
Richer	13.5	6.4-26.5	14.2	8.5-22.8	36.2	25.8-48.0	286	.008	↗
Middle	18.0	10.7-28.7	10.2	5.1-19.4	33.0	22.1-46.2	287	.056	
Poorer	21.4	13.2-32.8	11.6	6.7-19.3	31.2	19.8-45.5	294	.164	
Poorest	17.3	11.1-26.0	23.5	15.3-34.3	53.9	40.2-67.1	353	.000	↗

Secondary +, complete secondary and higher education; ↗, significant increasing trend based on logistic regression.

months ($F_{1,986} = 8.29$, $P < .004$), children in Coast ($F_{1,164} = 8.91$, $P < .003$), Eastern ($F_{1,171} = 5.30$, $P < .002$), Rift Valley ($F_{1,233} = 8.87$, $P < .003$), children whose mothers could not read ($F_{1,484} = 5.24$, $P < .023$), and those whose mothers listened to radio weekly ($F_{1,1034} = 4.77$, $P < .029$).

3.2. Associations between sociodemographic variables and breastfeeding practices in 2008-2009

Bivariate analyses with 2008-2009 data were used to select independent variables for inclusion in logistic regression analyses (Table 6). Only province and area of residence had significant bivariate associations with all 4 feeding variables. Table 7 shows the results of logistic regression analyses with only variables that showed significant bivariate association with individual breastfeeding practices put in the regression models.

In model 1 (early initiation of breastfeeding), children born through cesarean delivery were almost 3 times more likely to be breastfed later than 1 hour after birth, compared to children having vaginal deliveries. Children in Western, Central, and Coast provinces had significantly higher odds of being breastfed later as compared to children in the Eastern province. Children born to mothers with incomplete primary education were more likely to be breastfed later than earlier, compared to those born to mothers who had completed secondary and/or higher education.

In model 2 (exclusive breastfeeding), children born through cesarean delivery were more likely to be exclusively breastfed compared to those with vaginal deliveries. Using the Eastern province as the reference category, children in the Coast and Nairobi were more likely to not be exclusively breastfed.

In model 3 (complementary feeding and breastfeeding), only the child's age was a significant predictor, with an increase in child's age increasing the odds of not receiving complementary food and breastfeeding.

In model 4 (bottle-feeding), the child's age and province were the only 2 variables that made significant contributions to the model. An increase in child's age was negatively correlated with bottle-feeding, whereas the odds of children in Nairobi being fed using a bottle was higher as compared to children in the Eastern province.

4. Discussion

This study set out to investigate trends in breastfeeding practices in Kenya using 3 surveys conducted in 1998, 2003, and 2008-2009. The study also conducted a multivariate analysis on the predictors of breastfeeding practices using the 2008-2009 survey. To summarize the main results, the trends in exclusive breastfeeding showed mostly significant improvement, although the starting point in 1998 was low (ranging from 13% to 21% in the various sociodemographic groups studied). The most dramatic improvement was for children in the poorest wealth quintile, with exclusive breastfeeding more than tripling at 54% in 2008-2009. We speculate that the breastfeeding health education efforts and campaigns in Kenya, referred to in the Introduction, may have had a real impact at all sociodemographic levels, but this cannot be confirmed by the limited data available in this study.

Conversely, the trends in early initiation of breastfeeding, complementary feeding and breastfeeding, and bottle-feeding were stagnant or slightly worsened in most of the sociodemographic groups studied. Although these trends are not encouraging, efforts to promote breastfeeding in Kenya may have averted what otherwise might have been strongly worsening trends. This is conjectural, however, since there is no way to know what might have happened in the absence of the breastfeeding education efforts that have been made.

Logistic regression models using the 2008-2009 data showed that accounting for other variables, the province where the mother resided was the most significant predictor of early initiation of breastfeeding, exclusive breastfeeding, and bottle-feeding. This raises the question, what is it about one's province of residence that might affect child feeding? Three factors may be important in this regard: governmental and nongovernmental health organizations that foster child health, regional living conditions, and culture with its myriad of local expressions [18,30–34].

Turning first to health organizations, the Kenyan government has undertaken a number of initiatives including implementation of the joint WHO/UNICEF principles on a global strategy for infant and young child feeding through the

Table 4 – Trends in complementary feeding and breastfeeding for children aged 6-23 months									
	KDHS 1998		KDHS 2003		KDHS 2008-2009				
	%	95% CI	%	95% CI	%	95% CI	Grand n	P	Trend
Total	81.9	79.8-83.8	83.7	81.3-85.9	78.8	75.7-81.5	4657	.075	
Sex									
Female	80.9	77.6-83.7	83.0	79.1-86.2	77.9	72.6-82.5	1952	.338	
Male	82.9	79.8-85.6	84.2	81.2-86.8	79.3	75.4-82.7	2705	.107	
Province									
Nairobi	70.2	63.1-76.4	75.2	65.3-83.0	63.1	53.1-72.1	302	.267	
Central	79.0	70.9-85.3	75.2	69.8-79.9	81.0	72.7-87.1	449	.745	
Coast	79.0	69.5-86.1	86.5	80.6-90.8	79.8	70.4-86.7	702	.998	
Eastern	89.4	84.5-92.8	94.2	90.7-96.5	86.5	79.9-91.1	630	.410	
Nyanza	82.9	78.0-86.8	83.9	76.1-89.5	77.0	71.9-81.4	774	.083	
Rift Valley	80.1	75.7-83.8	81.5	75.9-86.1	78.2	70.4-84.3	1142	.616	
Western	85.2	80.0-89.2	84.3	77.6-89.2	78.7	68.7-86.1	658	.176	
Residence									
Urban	74.3	68.6-79.3	78.1	71.3-83.6	70.5	66.3-74.3	1029	.232	
Rural	83.7	81.4-85.7	85.0	82.4-87.3	81.0	77.4-84.1	3628	.168	
Wealth index									
Richest	70.4	64.6-75.6	77.1	70.3-82.7	70.5	65.0-75.5	935	.911	
Richer	84.1	78.8-88.2	81.9	76.5-86.3	81.6	74.1-87.4	813	.558	
Middle	82.9	77.9-86.9	82.1	76.5-86.6	81.0	74.1-86.4	850	.629	
Poorer	83.5	78.6-87.4	87.1	82.0-90.9	79.5	72.8-84.9	960	.300	
Poorest	86.7	83.0-89.6	88.5	84.4-91.7	81.4	76.1-85.8	1099	.072	
Maternal education									
Secondary +	75.4	68.0-81.4	73.3	65.6-79.8	71.8	63.4-78.8	690	.494	
Incomplete secondary	77.5	69.9-83.7	78.9	70.7-85.4	77.0	67.0-84.7	419	.937	
Complete primary	84.8	80.5-88.3	87.0	83.1-90.1	81.2	76.2-85.4	1281	.200	
Incomplete primary	82.3	78.8-85.3	84.8	80.9-88.1	79.0	73.0-83.9	1665	.313	
No education	86.8	79.5-91.8	87.1	80.1-91.9	83.0	74.8-88.9	602	.418	
Maternal literacy									
Reads easily	79.9	77.0-82.6	83.2	80.3-85.7	78.2	74.8-81.3	2985	.361	
Reads with difficulty	83.8	79.2-87.7	81.6	73.2-87.9	74.6	67.1-80.8	715	.022	↘
Cannot read	86.6	81.0-90.8	86.2	81.0-90.1	85.3	79.0-89.9	934	.717	
Mother reads newspaper									
Yes	76.7	72.3-80.5	82.2	78.3-85.5	75.9	71.0-80.2	1548	.710	
No	84.5	81.9-86.7	84.6	81.7-87.1	80.4	76.6-83.6	3101	.055	
Mother watches television									
Yes	72.7	67.3-77.6	80.4	75.9-84.2	76.5	72.0-80.6	1336	.484	
No	84.4	82.2-86.4	85.0	82.3-87.4	80.1	75.7-83.9	3307	.063	
Mother listens to radio									
Yes	80.2	77.1-83.0	83.2	80.5-85.6	78.1	74.6-81.3	3415	.213	
No	83.9	80.7-86.7	86.4	80.8-90.6	82.5	76.4-87.3	1236	.872	

Secondary +, complete secondary and higher education; ↘, significant decreasing trend based on logistic regression.

Baby Friendly Hospital Initiative and recent passing of a law regulating breast milk substitutes [35,36]. The encouraging trends in exclusive breastfeeding with significant increases in most sociodemographic groups could be an indicator of the impact of such initiatives. Nonetheless, it also raises the question of whether a focus on exclusive breastfeeding has overshadowed messages about the importance of feeding colostrum within an hour after birth, continued breastfeeding after complementary foods are introduced, and avoiding feeding children using bottles and teats. With regard to health facility deliveries, 76% of mothers in Kenya who delivered at a health facility were successfully aided in breastfeeding their babies within an hour after birth, but such health facility deliveries account for just 43% of all deliveries [11]. Mothers delivering at a health facility are likely to get counseled by health workers on the importance of early initiation of breastfeeding, contrary to those giving birth at home [37].

Concerning the mode of delivery and consistent with other studies [38,39], children who were born through cesarean delivery instead of vaginal birth were not likely to be breastfed within an hour of birth, even though they were likely to be exclusively breastfed. Obstetric complications and the use of analgesics during cesarean deliveries are significant barriers to immediate initiation of breastfeeding [40].

The availability and use of health facilities for child birth play some role in early child care, including feeding practices. Yet incongruities exist, for example, in the Central province, which has relatively good health care facilities available, there are still worsening trends in early initiation of breastfeeding [41]. This leads to consideration of living conditions and culture.

Health behavior is influenced strongly by living conditions, cultural beliefs, and practices. Both living conditions and culture beliefs help explain, for example, why some mothers in developing countries opt to feed their newborn children

Table 5 – Trends in bottle-feeding for children aged 0-23 months

	KDHS 1998		KDHS 2003		KDHS 2008-2009				
	%	95% CI	%	95% CI	%	95% CI	Grand n	P	Trend
Total	22.3	20.1-24.7	22.4	19.9-25.1	19.7	17.1-22.4	6268	.135	
Sex									
Girls	23.5	20.2-27.2	24.2	20.5-28.4	19.2	15.4-23.8	2531	.144	
Boys	21.3	18.5-24.3	21.3	18.5-24.3	21.3	18.5-24.5	3737	.513	
Age									
0-5 mo	25.3	21.2-29.8	27.4	23.2-32.1	25.3	20.6-30.7	1568	.997	
6-11 mo	27.1	22.4-32.4	28.4	24.3-33.0	28.1	23.5-33.1	1683	.794	
12-23 mo	18.5	15.6-21.8	16.2	13.4-19.4	12.1	9.5-15.3	3017	.004	↘
Province									
Nairobi	29.3	19.7-41.3	35.8	28.7-43.5	44.0	31.4-57.5	424	.103	
Central	25.8	18.9-34.2	24.3	19.4-29.9	28.5	21.1-37.3	622	.680	
Coast	37.9	32.2-44.0	12.8	8.4-19.0	21.3	15.6-28.4	944	.003	↘
Eastern	25.8	19.9-32.8	17.3	12.3-23.7	15.8	11.2-21.9	845	.022	↘
Nyanza	14.6	10.8-19.5	23.3	17.4-30.4	21.4	16.5-27.3	1056	.062	
Rift Valley	26.0	22.0-30.4	29.5	24.2-35.5	15.6	11.1-21.4	1497	.003	↘
Western	6.6	3.6-11.5	11.0	7.2-16.3	13.2	9.3-18.3	880	.035	↗
Residence									
Urban	30.9	24.9-37.6	31.8	26.5-37.6	27.8	20.2-36.9	1387	.552	
Rural	20.3	18.0-22.8	20.3	17.5-23.3	17.6	15.1-20.5	4881	.139	
Wealth index									
Richest	35.0	29.2-41.3	32.0	26.7-37.7	26.0	18.7-35.0	1280	.091	
Richer	26.8	21.1-33.3	27.0	21.6-33.2	22.4	17.7-27.9	1109	.260	
Middle	19.4	15.3-24.2	17.4	13.5-22.0	19.4	14.6-25.1	1151	.998	
Poorer	16.6	13.4-20.4	19.3	14.5-25.3	16.9	12.4-22.5	1258	.940	
Poorest	16.7	13.3-20.8	18.2	13.8-23.5	14.7	11.3-18.8	1470	.436	
Maternal education									
Secondary +	31.8	26.5-37.7	33.0	27.0-39.7	23.7	18.2-30.3	956	.056	
Incomplete secondary	25.7	18.6-34.3	23.7	16.9-32.1	27.1	18.6-37.5	566	.836	
Complete primary	17.6	14.3-21.5	22.6	18.5-27.2	19.1	15.3-23.5	1702	.714	
Incomplete primary	20.2	17.2-23.5	17.7	14.3-21.6	16.9	13.5-20.9	2236	.177	
No education	23.9	17.9-31.1	24.6	19.6-30.5	17.5	11.5-25.9	808	.189	
Maternal literacy									
Reads easily	23.8	20.9-26.9	23.7	20.8-26.9	20.8	17.6-24.4	4056	.187	
Reads with difficulty	18.7	14.9-23.3	13.3	8.1-21.2	20.1	14.8-26.6	926	.829	
Cannot read	22.5	17.6-28.4	21.9	17.9-26.6	14.0	9.6-20.0	1254	.023	↘
Mother reads newspaper									
Yes	27.4	23.5-31.7	27.0	23.0-31.3	22.7	18.0-28.3	2110	.162	
No	19.9	17.4-22.7	20.1	17.4-23.1	17.9	15.3-20.9	4146	.300	
Mother watches television									
Yes	29.6	24.7-35.0	30.0	25.9-34.5	23.9	19.4-29.2	1791	.084	
No	20.3	17.9-22.9	19.6	16.9-22.5	17.2	14.3-20.5	4457	.130	
Mother listens to radio									
Yes	24.9	21.9-28.2	23.2	20.5-26.2	20.2	17.5-23.3	4643	.029	↘
No	19.1	16.2-22.3	18.4	13.9-24.0	16.5	11.8-22.5	1615	.437	

Secondary +, complete secondary and higher education; ↘, significant decreasing trend; ↗, significant increasing trend.

water, sugar, and honey rather than the immediately and freely available colostrum [32]. In this study, living conditions and culture may be the most palpable explanation of barriers to feeding children as recommended by health experts [18,30,31]. Suggestions for this come from a highly informative qualitative assessment of beliefs and attitudes regarding infant and young child feeding undertaken in Kenya [42]. Among the key findings, women were generally aware of the benefits of breastfeeding but had to cope with maternal workload (including employment outside the home) and family demands, cultural beliefs about when and what to feed their children, worries about breastfeeding's effects on a woman's physical appearance, stigmas associating exclusive

breastfeeding with the prevention of HIV transmission, and lack of social support for optimal breastfeeding practices.

This complex array of barriers to health-promoting child feeding practices has significance for understanding the most robust finding of this study. There exist important differences from region to region in feeding practices (Tables 2–5), and there are different regional patterns for the 4 feeding practices that were studied (Table 7). The aforementioned assessment of beliefs and attitudes [42] included an analysis that revealed regional differences in the significance of many feeding barriers, as perceived by mothers, fathers, grandmothers, community health workers, traditional birth attendants, nurses, women's leaders, and nongovernment organization

Table 6 – Bivariate analysis between early initiation of breastfeeding, exclusive breastfeeding, complementary feeding and breastfeeding, and bottle-feeding with predictor variables, KDHS 2008-2009

Variable	Early initiation of breastfeeding		Exclusive breastfeeding		Complementary feeding and breastfeeding		Bottle-feeding	
	χ^2	P	χ^2	P	χ^2	P	χ^2	P
Gender	0.50	.479	0.01	.905	0.42	.519	0.14	.704
Child's mode of delivery	29.58	.000	12.00	.001	1.07	.301	0.98	.323
Child's size at birth	20.74	.000	1.35	.510	3.08	.215	6.71	.035
Child's place of birth	2.71	.099	0.08	.779	5.95	.015	18.23	.000
Province	162.46	.000	22.66	.001	23.13	.001	71.25	.000
Residence	18.33	.000	6.99	.008	18.19	.000	22.14	.000
Wealth index	3.59	.464	20.33	.000	17.14	.002	22.65	.000
Maternal education	18.09	.001	7.95	.094	11.12	.025	14.98	.005
Maternal occupation	11.03	.004	1.07	.587	9.15	.010	0.40	.818
Maternal literacy	9.14	.010	2.38	.305	9.38	.009	8.54	.014
Maternal newspaper reading	1.87	.171	12.08	.001	4.45	.035	7.22	.007
Maternal television watching	2.41	.121	5.45	.020	2.88	.090	14.21	.000
Maternal radio listening	3.95	.047	1.81	.178	2.21	.137	2.29	.130
	F	P	F	P	F	P	F	P
Child's age	5.82	.199	0.05	.000	5.09	.000	61.24	.000
Mother's age	2.23	.000	0.03	.254	12.29	.018	14.45	.000
Birth order	1.51	.000	0.34	.758	7.62	.000	37.26	.000
No. children aged ≤5 years	11.62	.704	0.08	.406	1.49	.006	0.98	.147
Parity	0.08	.000	1.68	.566	10.07	.000	51.17	.000

representatives. In Nairobi, social support at social gatherings (eg, church), slum dwelling, and abandonment by the father were mentioned. In the Western province, family size, beliefs about the "evil eye," isolation of mothers with twins, and marital conflict were cited. In the Rift Valley, drought impacts and grandmothers' control were pointed out. In Nyanza, domestic abuse was mentioned. In the Eastern province, maternal promiscuity and the mother's age were of significance. In the Coast province, overburdening social roles and low literacy levels were named. In the Central province, a spillover effect of HIV and religious influence was cited. Some of these factors (among many others that were mentioned) were ubiquitous across the provinces, whereas others were more localized.

This analysis points to a limitation and a strength of a quantitative method such as used by the DHS, in which contextual factors are accounted for "merely" by gross proxy measures such as region of residence, urban/rural location, religion, or ethnicity. Although the limitation is obvious, perhaps less so is the advantage. The present analysis confirms that "something" about the regional contexts of Kenya is important in determining the feeding experiences of infants, and that "something" is likely an array of many factors whose expression varies from place to place. This reinforces the intuition that infant feeding is a "local" phenomenon, and that public health action to address feeding inadequacy requires local anchoring, which national campaigns do not necessarily achieve.

Several limitations deserve attention. To enable comparison of prevalence in exclusive breastfeeding and complementary feeding and breastfeeding, this study used a subset of DHS feeding questions that were the same across the 3 surveys. The later surveys included additional questions on feeding that

were not used. It is also important to note that children excluded due to lack of feeding data are those who did not sleep in the household the night before the interview, who did not have valid dates of birth and valid measures of height and weight, and those whose mothers were not interviewed. For example the Child Record for the DHS 2008 survey lists 6079 children under five, of which 5706 had valid dates of birth, and of which 5450 had valid height and weight measurements (89.7%).

Also important is the issue of sample size and the effects that varying sample sizes have on statistical tests of linear trends, as reported in Tables 2 to 5. The sensitivity of statistical testing to sample size is such that 2 trends based on identical prevalence estimates may be statistically significant in the 1 case and not in the other. We know of no method to overcome this problem except to select samples of equal size, which was not a feature of the DHS sampling design. One may also question if the subgroup sample sizes are large enough. This is an important and relevant question when planning a study and when the magnitude of the effect one wishes to detect is specified. Then, sample size may be adjusted to achieve a certain level of statistical power, conventionally 0.80 or greater. However, the KDHS was not designed with such considerations in mind, and sample sizes were determined on the basis of the wish to produce nationally representative samples and with practical data collection limitations in mind. This points to an important limitation of this study, as it is now fairly well established that post-study (post hoc) power calculations to aid in the interpretation of results should be avoided [43–45]. The post hoc analyses in this article, also called *data snooping*[46], are perhaps best evaluated in terms of confidence intervals and not P values: "…the breadth of the interval tells us how confident we can be of the true state of nature being close to the null. Once we have constructed a confidence interval, power calculations yield no

Table 7 – Logistic regression with initiation of breastfeeding within 1 hour of birth, exclusive breastfeeding, complementary feeding and breastfeeding, and bottle-feeding as the dependent variables, KDHS 2008-2009

Variables	Model 1: early initiation of breastfeeding			Model 2: exclusive breastfeeding			Model 3: complementary feeding and breastfeeding			Model 4: bottle-feeding		
	Significance of Wald	OR	95% CI	Sig. of Wald	OR	95% CI	Sig. of Wald	OR	95% CI	Sig. of Wald	OR	95% CI
Child's age				0.000	1.50	1.27-1.77	0.000	1.20	1.14-1.26	0.000	0.93	0.91-0.95
Mode of delivery	.000			0.001								
Vaginal (reference)												
Cesarean		2.88	1.79-4.64		0.22	0.09-0.52						
Child's size at birth	.009									0.391		
Large (reference)												
Average		0.75	0.56-1.00								0.79	0.56-1.11
Small		1.22	0.83-1.79								0.91	0.57-1.47
Child's birth order	.740	0.96	0.74-1.23				0.870	1.03	0.70-1.52	0.962	0.99	0.73-1.35
Child's place of birth							0.396			0.497		
Health facility (reference)												
Home								0.81	0.50-1.32		0.88	0.62-1.27
Province	.000			0.006			0.197			0.025		
Eastern (reference)												
Nyanza		1.36	0.82-2.25		2.02	0.82-4.96		2.05	1.05-4.02		1.30	0.78-2.16
Western		6.06	3.60-10.20		1.70	0.59-4.89		1.85	0.83-4.11		0.77	0.42-1.41
Central		2.47	1.44-4.25		2.70	0.86-8.49		1.44	0.67-3.09		1.66	0.93-2.97
Rift Valley		1.60	0.87-2.93		2.14	0.85-5.39		1.73	0.81-3.69		1.02	0.57-1.82
Nairobi		1.35	0.66-2.77		4.91	1.33-18.09		3.22	1.31-7.93		3.08	1.34-7.12
Coast		4.43	2.29-8.59		6.25	2.49-15.71		1.81	0.83-3.95		1.39	0.80-2.43
Residence	.092			0.422			0.344			0.471		
Urban (reference)												
Rural		0.64	0.38-1.08		0.70	0.30-1.67		0.75	0.40-1.37		0.81	0.45-1.45
Wealth index				0.039			0.894			0.273		
Richest quintile (reference)												
Richer quintile					1.42	0.64-3.16		1.02	0.49-2.12		1.39	0.76-2.54
Middle quintile					1.64	0.61-4.42		1.31	0.60-2.83		1.48	0.73-3.01
Poorer quintile					2.52	0.94-6.73		1.38	0.58-3.30		1.30	0.59-2.85
Poorest quintile					0.72	0.25-2.09		1.32	0.55-3.16		1.00	0.47-2.13
Maternal education	.004						0.585			0.726		
Secondary + (reference)												
Incomplete secondary		1.19	0.66-2.12					0.93	0.43-1.98		1.36	0.78-2.37
Complete primary		1.29	0.80-2.08					0.82	0.47-1.43		1.02	0.65-1.61
Incomplete primary		2.15	1.34-3.45					1.03	0.45-2.37		1.12	0.63-1.99
No education		1.70	0.77-3.75					1.67	0.46-6.00		1.49	0.59-3.77
Maternal occupation	.090						0.283					
White collar (reference)												
Blue collar		1.54	1.03-2.31					0.96	0.62-1.48			
Not working		1.55	1.01-2.36					1.37	0.88-2.13			
Maternal literacy	.082						0.050			0.273		
Reads easily (reference)												
Reads with difficulty		0.66	0.42-1.06					1.24	0.76-2.03		1.24	0.72-2.11
Cannot read		1.18	0.74-1.88					0.47	0.22-1.03		0.73	0.40-1.32
No. children aged <5 y							0.436	1.10	0.86-1.41			
Mother's age	.879	1.00	0.96-1.03				0.523	1.02	0.96-1.08	0.897	1.00	0.96-1.04
Parity	.767	0.96	0.73-1.26				0.349	0.83	0.56-1.23	0.576	0.92	0.67-1.25
Mother reads newspaper weekly				0.042			0.813			0.943		
Yes (reference)												
No					0.54	0.30-0.98		1.05	0.71-1.54		1.01	0.70-1.46
Mother watches TV weekly				0.465						0.222		
Yes (reference)												
No					0.80	0.44-1.45					0.78	0.52-1.16
Mother listens to radio weekly	.028											
Yes (reference)												
No		0.65	0.44-0.96									

Secondary +, completed secondary and/or higher education; TV, television.

additional insights" [44]. Our position is that the sample sizes are what they are, our confidence in our interpretation of the data varies in part as a function of sample sizes, and our level of confidence is reflected in a conventional way, in the reported confidence intervals. A DHS study with larger or smaller samples sizes would have come to some different conclusions. Here, we are limited to reporting the findings with the data that are actually available.

In conclusion, long-term trends in exclusive breastfeeding are improving, whereas trends in early initiation of breastfeeding, complementary feeding and breastfeeding, and bottle-feeding are mostly stagnant. The province where the mother resided was a significant predictor of early initiation of breastfeeding, exclusive breastfeeding, and bottle-feeding. Since 2009, numerous child feeding education initiatives have been carried out in Kenya. The present findings suggest that such initiatives, which emphasize the importance of exclusive breastfeeding in the first half year of life, should not overlook education that focuses on the vital importance of feeding colostrum, continued breastfeeding up to 2 years of age or beyond, and the avoidance of bottle-feeding when stringent hygiene cannot be practiced due to lack of resources and unhygienic conditions. The results of this study also point to the importance of research to develop a better understanding of how local contexts influence child care and feeding practices. Large-scale survey research is definitely needed to continue to monitor national and regional trends, but in tandem with small-scale qualitative and mixed-methods research, to better inform interventions that are sensitive, respectful, and responsive to local living conditions and culture.

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