Feeding patterns and growth of term infants in Eldoret, Kenya

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Abstract

Background. *There are limited longitudinal data from developing countries on early infant feeding and growth patterns. In Kenya only 34.8% of infants are exclusively breastfed at 2 months. This finding is of concern, and further understanding of infant feeding and growth patterns is important.*

Objective. *To determine the feeding and growth patterns of Kenyan term infants during early infancy.*

Methods. *A longitudinal study was conducted. One hundred and fifty-one resource-constrained mother–infant pairs were recruited from the West Municipal Health Centre (WMHC) within 24 hours after birth, and subsequent follow-up was performed at the WMHC Maternal and Child Health Clinic. Data on baseline characteristics were collected with the use of a structured questionnaire. Data on nonbreastmilk liquids given to the infants and feeding patterns were gathered with the use of a 24-hour recall. Standard procedures were used to measure infant weight, recumbent length, and head circumference. World Health Organization (WHO) growth standards were used, and tests for variation between and within group means were performed, with* $\alpha < .05$ *regarded as indicating significance.*

Results. *At 6 and 10 weeks, the prevalence of exclusive breastfeeding was 40.4% and 9.9%, respectively. The mothers cited "aids infant's digestion" (38%) as the main reason for partial breastfeeding and "breastmilk was not enough" (48%) as the main reason for predominant breastfeeding. Growth velocity based on weight was similar to that in the WHO reference group. All of the children had normal growth (z-score > –2). Mothers without knowledge about WHO/UNICEF early infant feeding recommendations and those who initiated breastfeeding more than 1 hour post partum were ninefold and eightfold more likely to start mixed feeding by 10 weeks of age, respectively.*

Conclusions. *There is a need to accelerate awareness of optimum infant feeding recommendations and augment the rigorous practice of the WHO Ten Steps to Successful Breastfeeding.*

Key words: Exclusive breastfeeding, growth pattern, mixed feeding, term infants, urban resource-constrained population.

Background

There are very limited longitudinal data from developing countries on early infant feeding patterns in relation to growth. Exclusive breastfeeding is recommended for the first 6 months of life, since it provides all the nutrients required for optimal early growth [1, 2]; however, it is rarely practiced by most mothers [3, 4]. When a mother initiates breastfeeding immediately after birth, breastmilk production is stimulated [5] and the likelihood of exclusive breastfeeding is increased. The nutrient needs of full-term, normal-birthweight infants typically can be met by breastmilk alone for the first 6 months if the mother is well nourished [6].

Adequate nutrition in the period from birth to 24 months is particularly important because this is a period of rapid growth and brain development [5]. Early infant feeding practice is a major preoccupation of the mother, and it affects the health of an individual throughout the life cycle [7]. Prelacteal feeding—giving liquids or foods other than breastmilk prior to the establishment of regular breastfeeding—deprives the child of the valuable nutrients and protection provided by colostrum and exposes the child to the risk of infection [5]. Suboptimal breastfeeding increases the risk of poor nutrient intake and illness [1, 8], so that the infant's "life fight" starts with subnormal stores of nutrients [9].

Underweight in infants remains a pervasive problem

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in developing countries, where poverty is a strong underlying determinant contributing to household food insecurity, poor child care, maternal undernutrition resulting in small-for-gestational age infants, unhealthy environments, and poor healthcare [10]. According to the Kenya Demographic and Health Survey [11], 11% of infants under 6 months of age are stunted and 8% are underweight. Only 34.8% of children under the age of 2 months in Kenya are exclusively breastfed. The implication of these findings is of concern, since much effort has been expended in developing countries, including Kenya, in promoting exclusive breastfeeding for the first 6 months of life, as recommended by the World Health Organization (WHO), the UNICEF Baby Friendly Hospital Initiative (BFHI), and related organizations [12].

The objective of this study was to evaluate the breastfeeding patterns and growth of term infants from birth to 10 weeks of life. The research questions addressed were: what is the extent to which optimum breastfeeding is performed during the first 10 weeks of life, and what is the growth pattern of these infants during this period?

Methods

The study was approved by the Moi University and Moi Teaching and Referral Hospital Institutional Research and Ethics Committee prior to commencement of the study (approval number 000246). After the nature and objectives of the study had been explained to the mothers, informed consent, both written and oral, was obtained from the mothers of all the infants who enrolled in the study.

A longitudinal study design was used. Mother–infant pairs were recruited at birth, and each pair was contacted at 6 and 10 weeks post partum. The population was from urban-based, resource-constrained communities. Mothers who gave birth at the West Municipal Health Centre (WMHC) between May and August 2007 were recruited, and subsequent follow-up was done at the WMHC Maternal and Child Health Clinic (MCH) up to November 2007.

Subjects

Two hundred fifty-seven mothers were serially approached to participate in the study. After they had been examined to determine if they fulfilled the inclusion criteria (**fig. 1**), 177 mothers agreed to participate in the study. The main reason for nonparticipation ($n = 17$) was the perceived long waiting time every time they visited the clinic. Twenty-six mothers were lost to follow-up because they moved out of the area and could not come to the MCH for postnatal care. Complete data were finally obtained from 151 mother–infant pairs.

Data collection

A structured questionnaire was used to obtain data on the socioeconomic characteristics of the mothers at the time of the birth of their children. A 24-hour recall was used to collect information on nonbreastmilk liquids given to the infants and feeding patterns within 24

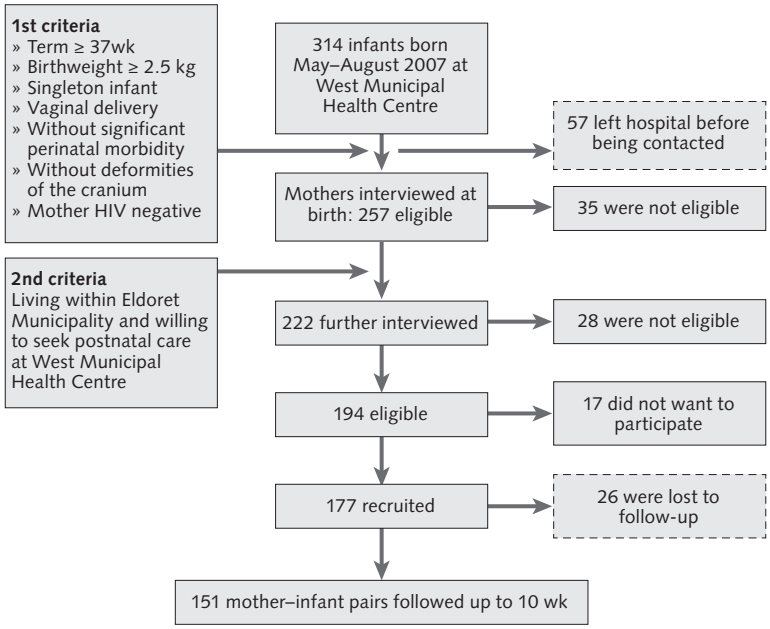

FIG. 1. Eligible subjects at recruitment and follow-up

hours after birth and at 6 and 10 weeks post partum. On the basis of the questionnaire, the infants were classified into three groups based on WHO definitions. Exclusively breastfed infants were fed on breastmilk only, with medicine and supplements allowed if recommended. Predominantly breastfed infants were fed on breastmilk, with water, tea, or juice given on no more than 3 days per week. Partially breastfed infants were fed on breastmilk, with formula or cow's milk given every day. For regression analysis, the predominant breastfeeding and partial breastfeeding categories were collapsed to a mixed feeding category because of the limited number of subjects in the predominantly breastfed group at 10 weeks of life. Mixed-fed infants received both breastmilk and any other food or liquid, including water, nonhuman milk, and formula.

Anthropometric measurements of body weight, recumbent length, and head circumference were also taken within 24 hours after birth and at 6 and 10 weeks. Infants were weighed without clothes to the nearest 0.10 kg with a pediatrics weighing scale (SECA 770 Corporation Weighing and Measuring System) after the scale had been properly calibrated. Supine length was measured with a portable, locally constructed length board to the nearest 1 mm. The infant was placed facing upwards with the head toward the fixed end and the body parallel to the long axis of the board. Head circumference was measured to the nearest 1 mm with a nonstretchable flexible tape. The tape was fitted around the infant's head, going from the supraorbital ridge to the occipital protuberance.

Data analysis

Z-scores for weight-for-age (WAZ), weight-for-length (WLZ), head-circumference-for-age (HCZ), and length-for-age (LAZ) were derived based on the WHO Multicentre Growth Reference Study (MGRS) reference group with the use of WHO Anthro Version 2.0 software for child growth standards in monitoring growth. Growth status was determined according to whether the mean z-scores were below or above –2 SD of the MGRS reference group [13].

The data were analyzed with the SPSS statistical package, version 16.0. To explore relationships between variables, chi-square tests were used. Tests for significant variations between and within group means were performed by multivariate analysis of variance (ANOVA). Logistic regression analysis was used to determine which variables were the best predictors of breastfeeding patterns [14]. All tests were two sided, and a p value < .05 was regarded as indicating statistical significance. To create variables for the model, dependent variable inclusion was set at a p value of .05 and exclusion at .01. If an interaction was not significant, it was left out of the model.

Results

Maternal characteristics

Table 1 presents the baseline characteristics of the mothers enrolled and successfully followed up to 10

TABLE 1. Baseline characteristics of the mothers

Characteristic	Category	Percent (no.)
Age (yr)	≤ 25	62.9 (95)
	> 25	37.1 (56)
Parity	< 1	31.1 (47)
	≥ 2	68.9 (104)
Marital status	Married	96.0 (145)
	Single	4.0 (6)
Employment status	Unemployed	60.3 (91)
	Self-employed	19.2 (29)
	Employed by others	20.5 (31)
Total monthly household income (Kenya shillings)[a]	≤ 2,400 (low)	80.8 (122)
	2,401–7,200 (medium)	6.6 (10)
	≤ 7,201 (high)	12.6 (19)
Formal education (yr)	< 12	60.3 (91)
	≥ 12	39.7 (60)
Time after birth to initiation of breastfeeding (h)	≤ 1	4.6 (7)
	> 1	95.4 (144)
Mother has knowledge of WHO infant feeding recommendations	Yes	54.3 (82)
	No	45.7 (69)

a. US$1.00 = 80.0 Ksh.

TABLE 2. Infant breastfeeding patterns—percent (number) of mother–infant pairs

Age (weeks)	Exclusive breastfeeding % (*n*)	Predominant breastfeeding % (*n*)	Partial breastfeeding % (*n*)
6	40.4 (61)	27.2 (41)	32.4 (49)
10	9.9 (15)	1.3 (2)	88.8 (134)

weeks. The mothers' mean age was 24.6 ± 4.13 (SD) years, ranging from 16 to 37 years, with 62.9% being 25 years of age or younger. There were 68.9% and 31.1% multiparous and primiparous mothers respectively. The majority of the mothers (60.3%) were not employed, 19.2% were self-employed, and 20.5% were employed by others. Monthly household income was low for 80.8%, medium for 6.6%, and high for 12.6% of the mothers. More than half of the mothers (60.3%) had dropped out of school before completing 12 years of secondary education.

The vast majority of the mothers (95.4%) initiated breastfeeding more than 1 hour after birth, and only 4.6% initiated breastfeeding within 1 hour. A little more than half of the mothers (54.3%) knew the recommended duration of exclusive breastfeeding. Mothers' knowledge about WHO/UNICEF infant feeding recommendations had a significant effect on the pattern of infant feeding at 10 weeks ($\chi^2 = 5.656$, $p < .05$).

Fifty-one percent of the infants ($n = 77$) were boys and 49% ($n = 74$) were girls. Their mean gestational age at birth was 38.36 ± 1.60 weeks. Based on the chi-square test, all maternal characteristics were independent except the mother's knowledge about WHO/UNICEF infant feeding recommendations.

Table 2 shows that at 6 weeks less than half of the infants (40.4%) were exclusively breastfed (EBF) ($n = 61$), and at 10 weeks only 9.9% were still EBF ($n = 15$).

Reasons for mixed feeding

Figures 2 and **3** show the reasons cited by mothers for early introduction of water-based drinks and other food to the infant. The reasons for introducing

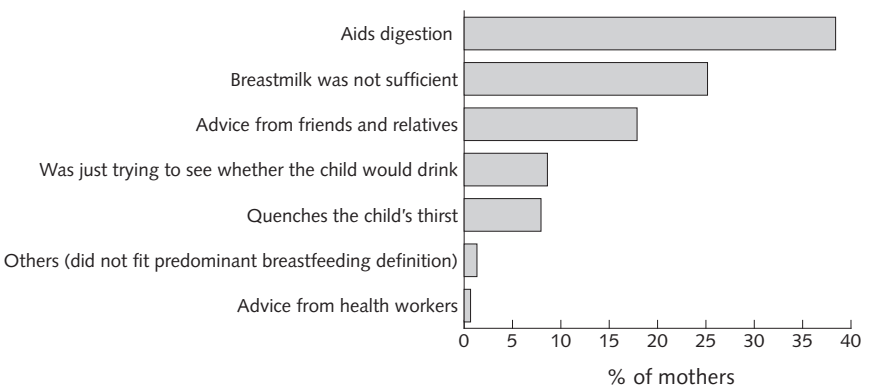

FIG. 2. Reasons for introduction of water-based drinks (predominant breastfeeding)

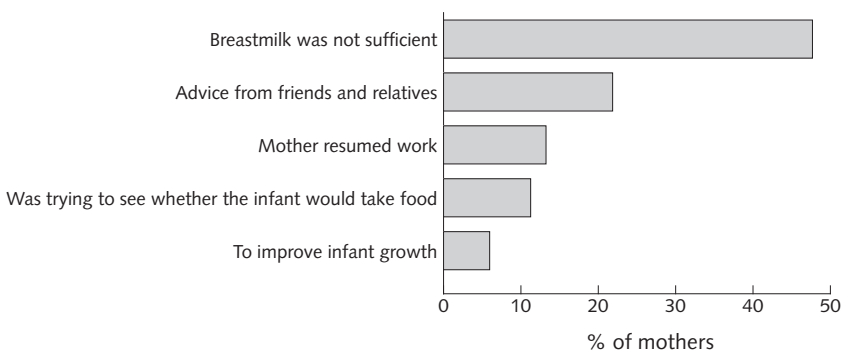

FIG. 3. Reasons for introduction of other foods (partial breastfeeding)

water-based drinks (predominant breastfeeding) were as follows: 38% (n = 58) said that the child was crying from colic pain and they believed water-based drinks would aid digestion, 25% (n = 38) said that breastmilk alone was not enough for the child, 18% (n = 27) said they were advised by friends and relatives to give water-based drinks, 9% (n = 13) said they were trying to see whether the child would drink, 8% (n = 12) said they wanted to quench the child's thirst, and 1% (n = 1) said they were advised by the health workers to give water-based drinks.

The mothers gave the following reasons for introducing other food (partial breastfeeding): 48% (n = 72) said that breastmilk alone could not satisfy the infant because the infant kept crying, 22% (n = 33) said their friends and relatives advised them to introduce other foods to the infant early so the child would get used to them, 13% (n = 20) said they needed to resume employment, 11% (n = 17) introduced the food because they were trying to see whether the infant would take it, and 6% (n = 9) introduced the food because they thought other foods in addition to breastmilk would improve growth.

Infant growth status and age of introduction of other food

The growth velocity of these infants based on weight was similar to that of the WHO Multicentre Growth Reference Study reference group [15] from birth to 10 weeks of life (**fig. 4**).

The results of one-way between-groups multivariate ANOVA on gender difference in growth status at birth, 6 weeks, and 10 weeks are as follows. Twelve dependent variables were used: WAZ, WLZ, HCZ, and LAZ at birth, 6 weeks, and 10 weeks respectively.

All of the children had normal growth based on z-scores > –2 of the growth indicators; however, the mean z-scores showed that boys had better growth status than girls. There was a significant difference between boys and girls the combined dependent variables: F (12, 138) = 6.595, p = .000; Wilk's lambda = 0.636; partial eta squared = 0.024). Significant differences were evident between boys and girls on WAZ, HCZ, and LAZ at 6 and 10 weeks respectively (**table 3**).

Factors associated with early mixed feeding

Table 4 shows the factors associated with mixed feeding at 10 weeks of age according to binary logistic regression analysis. Mixed feeding at 10 weeks was nine fold more likely if the mother did not know the WHO/UNICEF recommendations on early infant feeding (OR = 9.190; 95% CI, 1.715 to 49.231) and eightfold more likely if the mother initiated breastfeeding more than 1 hour after birth (OR = 8.189; 95% CI, 1.138 to 58.928).

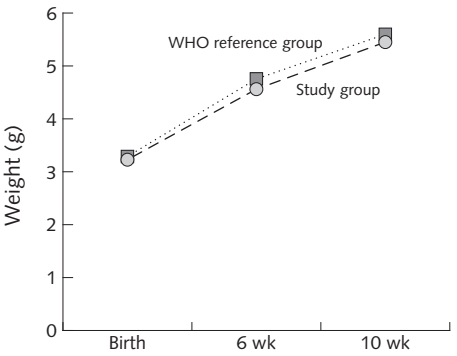

FIG. 4. Infant growth velocity based on weight

Discussion

This study found that the rate of exclusive breastfeeding was only 40.4% at 6 weeks and dropped to 9.9% at 10 weeks. These rates are in agreement with the findings of a study in Uganda [16] but are slightly lower than the rates found by the Kenya Demographic and Health Survey (KDHS): 29% at 2 months in 2004 and 51.8% at 0 to 1 month and 34.8% at 2 to 3 months in 2008/09 [11, 17]; however, these differences could be due to the fact that the KDHS results are based on a cross-sectional study design.

Breastfeeding practices are influenced by the mothers' knowledge on the recommended duration of exclusive breast-feeding. The mothers gave several reasons for introducing non breast-milk feeds to their infants before the infant attains the recommended age of complementary feeding. Forty-eight percent of mothers practicing partial breastfeeding and 25% of those practicing predominant breastfeeding said they did not think they had enough milk to satisfy the infant. These findings agree with those of other studies [18, 19]. Thirty-eight percent of mothers practicing predominant breastfeeding thought that giving food other than breastmilk would aid digestion; 18% of those practicing predominant breastfeeding and 22% of those practicing partial breastfeeding did so because of advice from friends and relatives. Many mothers introduce non breast milk feeds too early because they believe that all episodes of crying indicate hunger.

The growth patterns of these infants during this period were similar to those of the WHO reference group [15]. The possible explanations for these findings are that only full-term infants with normal birthweight were included in the study and that the study subjects were followed up to only 10 weeks of age, before the impact of feeding on growth was evident. This result agrees with observations made by others [4, 20, 21]

TABLE 3. Growth status in relation to sex and age of infants

Age (wk)	Dependent variable[a]	Sex	Mean z-score	SE	95% CI	
					Lower	Upper
0	WAZ	M	–0.054	0.096	–0.242	0.135
		F	–0.190	0.094	–0.375	–0.005
	WLZ	M	1.176	0.091	0.997	1.355
		F	1.207	0.089	1.031	1.382
	HCZ	M	–0.368	0.133	–0.630	–0.106
		F	–0.705	0.130	–0.961	–0.448
	LAZ	M	–0.981	0.122	–1.223	–0.739
		F	–1.162	0.120	–1.400	–0.925
6	WAZ	M	–0.203	0.108	–0.415	0.010
		F	–0.745	0.106	–0.954	–0.537
	WLZ	M	0.432	0.149	0.138	0.727
		F	0.664	0.146	0.376	0.953
	HCZ	M	–0.964	0.104	–1.170	–0.759
		F	–1.611	0.102	–1.812	–1.409
	LAZ	M	0.293	0.082	0.131	0.456
		F	–0.248	0.081	–0.407	–0.088
10	WAZ	M	–0.133	0.092	–0.315	0.049
		F	–0.801	0.090	–0.979	–0.623
	WLZ	M	0.461	0.131	0.203	0.719
		F	0.353	0.128	0.100	0.606
	HCZ	M	–0.685	0.117	–0.916	–0.454
		F	–1.223	0.115	–1.449	–0.996
	LAZ	M	–0.838	0.109	–1.052	–0.623
		F	–0.515	0.107	–0.725	–0.304

HCZ, head-circumference-for-age z-score; LAZ, length-for-age z-score; WAZ, weight-for-age z-score; WLZ, weight-for-length z-score

a. Based on WHO Multicentre Growth Reference Study (MGRS) reference group for infant growth.

TABLE 4. Factors associated with mixed feeding at 10 weeks by binary logistic regression analysis. Block 1: method = backward stepwise logistic regression[a]

Risk of introducing other food by 10 wk. Exclusive breastfeeding (0), mixed feeding (1)[b]	Regression coefficient B (SE)	Wald	*p*	Odds ratio exp (B)	Exp (B) for 95% CI	
					Lower	Upper
Household income		5.696	.058			
Household income (1)	–0.838 (1.089)	0.593	.441	0.433	0.051	3.653
Household income (2)	1.170 (0.689)	2.878	.090	3.221	0.834	12.441
Mother's knowledge of WHO infant feeding recommendations (1)	2.218 (0.856)	6.709	.010	9.190	1.715	49.231
Time taken after birth before initiation of breastfeeding (1)	2.103 (1.007)	4.362	.037	8.189	1.138	58.928
Constant	–1.125 (1.135)	0.981	.322	0.325		

a. Classification table: overall percentage 90.1; model $\chi^2 = 16.062$, df 4, $p = 0$ .003; Hosmer–Lemeshow test 5.238, df 3, $p = 0.155$.

b. Coding variables: household income, high = 0, medium = 1, low = 2; mother's knowledge of WHO infant feeding recommendations, 0 = know, 1 = don't know; time before initiation of breastfeeding, 0 = ≤ 1 hour, 1 = > 1 hour.

and is different from the results of the KDHS [11], which found a stunting prevalence of 11% and an underweight prevalence of 8% in infants less than 6 months of age, and a study in Vietnam [22] that found an association between early complementary feeding and poorer growth of the children.

This study shows that knowledge about WHO/UNICEF infant feeding recommendations is not extensive among mothers. More than half of the mothers did not know the recommended duration of exclusive breastfeeding. Regression analysis showed that mothers who did not know the recommendations were nine times more likely to start mixed feeding by 10 weeks. These findings may be attributed to inadequate prenatal and postnatal breastfeeding education. This association is supported by a previous study that found that inadequate breastfeeding information was given to mothers in the clinics in Eldoret town [23]. Other studies have also documented similar findings [24, 25].

The present study found that the great majority of the mothers (95.4%) did not initiate breastfeeding within 1 hour after birth, and if the child cried they would opt for prelacteal feeding, which deprives the infant of valuable nutrients. These results do not agree with those of a study reporting that 52.3% of Kenyan mothers initiated breastfeeding within 1 hour of birth [5] and the KDHS finding that 58% of mothers did not give prelacteal feeds [11]. Ideally, all hospitals would be required to practice the WHO Ten Steps to Successful Breastfeeding [26], but this was not the practice in the present study. The obstacles to following the WHO Ten Steps should be further examined. Regression analysis revealed that mothers who did not initiate breastfeeding within 1 hour after birth were eight times more likely to start mixed feeding by 10 weeks than mothers who initiated breastfeeding within 1 hour after birth. These findings conform to those of a study in Athens that found a positive association between late initiation of breastfeeding and poor maintenance of exclusive breastfeeding for 40 days [27].

A limitation of this study is that it was based only on activities in one health center in Eldoret town. There are other health centers within the town that have similar characteristics. The findings are therefore viewed as indicative of general breastfeeding patterns rather than population estimates. In spite of this limitation, we think this study adds to a much-needed literature on breastfeeding patterns and infant growth in sub-Saharan Africa.

Conclusions

In this study, the prevalence of exclusive breastfeeding at 6 weeks was low (40.4%) and decreased to 9.9% by 10 weeks. The factors associated with early introduction of other food were low maternal knowledge about WHO infant feeding recommendations and delayed (> 1 hour) initiation of breastfeeding after birth. The growth status of these infants was normal, but boys had better growth than girls. There is a need to address the weaknesses that curtail exclusive breastfeeding during the first 10 weeks of life, increase awareness among women of optimum feeding recommendations for infants, and promote the rigorous practice of the WHO Ten Steps to Successful Breastfeeding. Further longitudinal studies with sufficient sample sizes should be done to evaluate the obstacles to following the WHO Ten Steps, and more advocacy is needed to improve exclusive breastfeeding.

Acknowledgments

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