

Practice of Kangaroo Mother Care Among Low-Birth-Weight Infants Discharged from Health Facilities and Its Outcome in Mekelle City, Tigray, Northern Ethiopia

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Background: Kangaroo mother care is a proven intervention shown to be effective in reducing neonatal mortality among low-birth-weight infants. The paucity of evidence regarding the practice at home can be highlighted. This study aimed to assess the practice and outcome of kangaroo mother care at home among mothers having low-birth-weight infants discharged from two hospitals in Mekelle, Tigray, Ethiopia.

Methods: A prospective cohort study was conducted among 101 paired mothers and low-birth-weight neonates discharged from Ayder and Mekelle Hospitals. Non-probability purposive sampling was used to select 101 infants. Data were collected from patient charts in both hospitals using interviewer-administered structured questionnaire, anthropometric measurements and were then analyzed using SPSS version 20. Characteristics were analyzed using descriptive statistics. Bivariate analysis was used, and variables with p-value <0.25 were exported to multivariable logistic regression and statistical significance was set at a p-value <0.05.

Results: Kangaroo mother care was continued at home in 99% of the infants. Three of the 101 infants died before the age of 4 months with a possible cause of death from respiratory failure. Exclusive breastfeeding was provided for 67% of the infants, and it was higher in infants who started kangaroo mother care within 24 hours of life (AOR 3.8, 95% CI 1.07–13.25). Malnutrition was higher in those with birth weight <1500 grams (AOR 7.3, 95% CI 1.63–32.59); small for gestational age (AOR 4.8, 95% CI 1.41–16.31) and those provided kangaroo mother care for <8 hours per day (AOR 4.5, 95% CI 1.40–16.31).

Conclusion: Early initiation and prolonged duration of kangaroo mother care were associated with increased exclusive breastfeeding practice and decreased incidence of malnutrition. Kangaroo mother care should be promoted at the community level.

Keywords: low birth weight, kangaroo mother care, malnutrition, exclusive breastfeeding

Introduction

Low birth weight (LBW) is defined by the World Health Organization (WHO) as weight at birth less than 2500 grams. Low birth weight (LBW) continues to be a significant public health problem globally and is associated with a range of both short- and long-term complications.¹ Worldwide, it is estimated that 15–20% of all births are low birth weight as a result of preterm birth or intrauterine growth restriction representing more than 20 million births a year. The great majority of low-birth-weight births occur in low- and middle-income countries. Regional estimates of low birth weight in sub-Saharan Africa is 13% of which 11% is in eastern and southern Africa.^{1,2}

Kangaroo mother care (KMC), as defined by the World Health Organization (WHO), is a care of preterm and LBW infants where the mother keeps the baby in skin-to-skin contact (SSC) on her chest between her bare breasts as continuous as possible, day and night, with exclusive breastfeeding. It is interrupted only for changing diapers and bathing the baby or for toilet and showering of the mother and it is continued until the baby no longer wants to stay in that position.^{2–4}

There is evidence that KMC in resource-limited settings significantly reduces the risk of mortality in infants born in facilities that are clinically stable and weigh less than 2000 grams. KMC also reduces the risk of hypothermia, severe illness, nosocomial infection, and length of hospital stay, and improves growth, breastfeeding, and maternal and infant attachment.^{4–6}

With appropriate counseling and guidance, different studies showed that the practice of KMC at home resulted in an increased rate of exclusive breastfeeding and decreased risk of death. This was noted with early initiation and prolonged use of KMC, which also facilitates the breastfeeding practice. The barriers to the continuation of KMC practice at home were mothers being busy at home, less support by family, twin babies, maternal discomfort of mother and baby in hot weather.^{6–10}

There are different context-based barriers in the community that can hinder the implementation of KMC at home such as social and cultural factors. This research was an initiative to look at the practice of KMC after discharge among mothers who initiated the care at health facilities and its effects on growth and development at the community level.

Methods

Study Area and Period

The study was conducted in Mekelle city, Tigray, North Ethiopia, from June 1, 2017, to February 30, 2018. Mekelle city has two public hospitals. One tertiary (Ayder) with Neonatal ICU including KMC unit with 40 beds and one General (Mekelle) Hospital with Neonatal ICU having 20 beds. This study was done on LBW infants discharged from these facilities, which were included under the KMC scale-up project which was funded by the WHO. There is KMC service in both hospitals and linkage to the community for continuation at home.

Study Design

A prospective cohort study was conducted for all LBW infants discharged from both hospitals.

Study Population

Study population includes all neonates with a birth weight <2000 grams who received KMC in Ayder Comprehensive Specialized Hospital and Mekelle General Hospital and were discharged home within the vicinity of Mekelle city.

Sample Size and Sampling Technique

In total, 101 mother–infant pairs were selected according to the inclusion and exclusion criteria. All neonates with a birth weight <2000 grams who received KMC in Ayder Comprehensive Specialized Hospital and Mekelle General Hospital and were discharged home were selected purposefully.

A total of 270 medical record numbers were extracted from the KMC register of both hospitals. Of these, 127 were from other areas outside Mekelle and 143 were from Mekelle city, then they were contacted with phone numbers extracted from the register. Among these, 17 mothers did not answer the call, 15 mothers changed their address outside Mekelle, and 2 mothers did not voluntarily participate in the study. Then, among the remaining 109 charts, 2 were found to be adult charts and 5 could not be found in the card room. One infant was found to have congenital heart disease (CHD). Finally, 101 infants and their caregivers were eligible for the study and were included in the study (Figure 1).

In this study, our dependent variables were practice of KMC, clinical outcome (survival, mortality, readmission), growth (weight, length, weight for length and head circumference for age), developmental milestones (social smile, sitting unsupported, crawling, standing unsupported, and saying “baba” or “mama”).

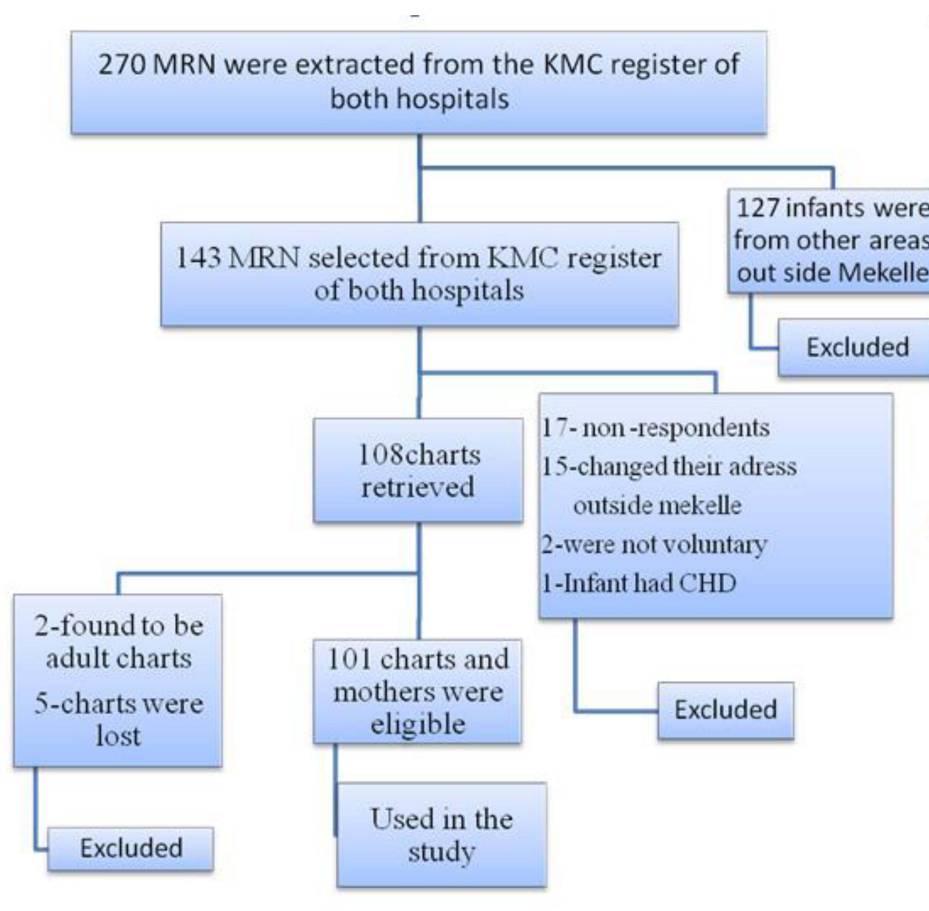


Figure 1 Sampling technique flow chart.

Data Collection Procedures

Data Collection Methods and Instruments

The interviewer administered a structured questionnaire, anthropometric measurement, and review of medical records was used to collect data among infants with a birth weight <2000 grams and their caregivers. The socio-demographic data of the infants and their baseline clinical profile were extracted using a checklist from their medical records. The socio-demographic data of the mothers, the clinical outcome of the infants, and the prevalence of the practice of kangaroo mother care at home were collected using the questionnaire from volunteer mothers or primary caretakers after verbal consent. Weight, length, and head circumference of the infants were taken by the interviewer at the time of the interview using standard methods of measurements. WHO growth standard with Z score interpretation was used.

Data Quality Assurance

To assure the quality of data, the following measures were undertaken. The designed data collection instruments were used, and the data were collected by trained data collectors. The questionnaire and checklist were pretested, and the clarity of language was checked. Every day the collected data was reviewed and checked for completeness and consistency of the responses.

Data Management and Analysis

Data were coded and entered into EPI Data 3.1 and then exported to SPSS version 20 for analysis after cross-checking, cleaning, and editing the collected data. Descriptive statistics using frequencies, proportion, and mean with ranges were used to analyze the data. Logistic regression analysis was carried out using bivariate analysis to determine the direction and strength of association between a set of independent variables and the dependent variable, then variables with

p-value <0.25 were selected to the final model, and statistical significance was declared at p-value <0.05 and CI of 95% in multivariable logistic regression. Odds ratio was used to test the strength of the association.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Review Committee (HRERC) of Mekelle University, College of Health Sciences with ERC Number of 1396/2018 as well as World Health Organization (WHO) Ethical Review Committee and the Health Research Ethics Review Committee (HRERC) of the Mekelle University with the reference of ERC 0740/2016 for KMC implementation research for an accelerating scale-up project (where both verbal and written consent was obtained) in Tigray, Ethiopia. KMC was one of the components of the health package care or the government standard of care to continue at home after the implementation of the scale up project, therefore only verbal informed consent was obtained from all mothers or legal guardians who continued the care at home (after discharge) before the commencement of the study. In addition, written permission was obtained from the medical director of both hospitals prior to the collection after the purpose of the study was explained. The study was conducted in accordance with the Declaration of Helsinki. All necessary information was explained to the study participants before being interviewed using the local language. All data were kept in a safe and secure place in order to ensure confidentiality.

Results

Socio-Demographic Characteristics of Study Participants

A total of 101 infants and their mothers or caregivers were included in the study among which 56(55.4%) were females. The minimum and maximum corrected age were 2.6 months and 12.7 months, respectively. The mean corrected age was 6.7 months. Ninety (89%) mothers were between 18 and 35 years of age, while the remaining 11% were above 35 completed years of age. Ninety-two (91.1%) mothers were married and 9(8.9%) mothers were single (Table 1).

Table 1 Socio-Demographic Characteristics of Mother and Their LBW Infants Discharged from ACSH and Mekelle General Hospital from June 1, 2017 to February 30, 2018

Variables		Frequency (N)	Percentage (%)
Maternal			
Age	18–35 years	90	89
	>35 years	11	11
Marital status	Single	9	8.9
	Married	92	91.1
Occupation	Housewife	71	70.3
	Student	3	3.0
	Government	17	16.8
	Employee		
	Merchant	5	5
	Others	5	5
Level of education	Illiterate	10	9.9
	Primary	34	33.7
	Secondary	28	27.7
	College and higher	29	28.7
Infant			
Sex	Male	45	44.6
	Female	56	55.4
Age	<6 months	35	35
	≥6 months	66	65

Obstetric and Delivery History of Mothers and Their LBW Infants

Thirty-three (32.6%) mothers were primipara, 3 (3%) reported they have no ANC visit, and 28 (27.7%) reported they have less than four ANC visits. Sixteen (15.8%) infants had very low birth weight (<1500 gm). Sixty-seven (67%) infants were born before 37 completed weeks of gestation and 6 mothers were not aware of their gestational age. The mean gestational age was 34.8 weeks. When the birth weight was standardized to the gestational age, 29(28.7%) of the infants were small for gestational age and 72(71.3%) were appropriate for gestational age. Forty-three (42.6%) infants were twins and 4(4%) were born as triplets (Table 2).

Baseline Clinical Condition of LBW Infants on Initial Admission

Eighty-seven (86%) of the infants had other indications for admission in addition to being LBW. Hypothermia was the commonest (63.4%) indication for admission followed by sepsis and respiratory distress syndrome (57.4% and 17.8%, respectively) (Table 3).

Table 2 Obstetric and Delivery History of Mothers and Their LBW Infants Discharged from ACSH and Mekelle General Hospital from June 1, 2017 to February 30, 2018

Variables		Frequency (N)	Percentage (%)
Parity	Primipara	33	32.7
	Multipara	68	67.3
ANC follow-up	No visit	3	3
	1–3 visits	28	27.7
	≥4 visits	70	69.3
Birth weight	1000–1499 gms	16	15.8
	1500–1999 gms	85	84.2
GA	<37 Wks	67	67
	≥37 Wks	27	26.7
Birth weight for GA	AGA	72	71.3
	SGA	29	28.7
Order of pregnancy	Single	54	53.4
	Twin	43	42.6
	Triplet	4	4
Mode of delivery	Vaginal	62	61.3
	Instrument assisted	5	5
	C/S	34	33.7
Place of delivery	Home	7	6.9
	Health facility	94	93.1

Table 3 Additional Diagnosis of LBW Infants Discharged from ACSH and Mekelle General Hospital from June 1/2017 to February 30/2018 (N=101)

Diagnosis*	Frequency	Percent
Sepsis	58	57.4
Hypothermia	64	63.4
Respiratory distress syndrome	18	17.8
Perinatal asphyxia	3	3
Neonatal jaundice	8	7.9
Others	2	2

Note: *A case can have one or more diagnosis.

KMC Practice of the Mothers While in the Hospital

The mean age of starting KMC was 136 hours (5.6 days). The minimum and maximum weights at the initiation of KMC in the hospitals were 1000 and 1999 grams, respectively. The mean weight at the initiation of KMC was 1667.17 grams. The minimum, maximum, and mean duration of hospital stay was 1 day, 42 days, and 12.43 days, respectively. Intermittent and continuous KMC was provided for 73% and 10% of the infants respectively during their hospital stay. Duration of KMC per day was not documented for the remaining 17%.

Practice of KMC at Home

All of the mothers reported that they continued KMC at home except one who did not continue it for the reason she reported: “to be busy at home”. Most of them reported they were providing KMC intermittently but 19% of them reported they were providing continuously for more than 20 hrs. In terms of KMC practice provided in the day, 70% of the infants were provided KMC ≥ 8 hours per day and 61% of the mothers were given support for KMC by different family members, among them 24%, 18%, and 13% of the mothers were supported KMC by their husbands, aunts, and grandmothers, respectively (ie, family members or husbands were providing KMC to help mothers).

The earlier age of discontinuation of KMC was 17 days and the maximum was 134 days; the mean being 56.5 days. Ninety-seven (96%) mothers reported there was no challenge in providing KMC, but 4 (4%) mothers from the intermittent and continuous KMC mentioned “back pain and discomfort during the nighttime”, “feeling hot” and “having C/S” as challenges in providing of KMC.

Clinical Outcome

A total of 101 infants and their mothers or caregivers were included in the study. Of these, 98 infants (97%) were alive and 3 infants (3%) have died. Among those who died, one died at home with the immediate cause of death being a breathing problem from verbal autopsy results, while the other two died in hospital with respiratory failure secondary to sepsis. Thirty percent of them were sick after discharge and all of them were taken to the hospital, of which 14(47%) were admitted. Respiratory complaints such as cough and fast breathing were the most common causes of readmission (57%) and one was readmitted with meningitis.

Breastfeeding Practice Among the LBW Infants

All of the mothers reported that they had breastfed their babies except two mothers. The minimum age at initiation of breastfeeding was 1 hour and the maximum was 10 days. The mean age of initiation of breastfeeding was 46.6 hours. Majority of the mothers (65%) reported they did not give any additional feeding before 6 months or at least before the time of the interview. One-third (35%) of mothers reported they started additional feeding (on top of breast milk) before 6 months age of the infant, among whom Formula milk with water was given for 31 infants (88%), but the remaining 4 infants were given boiled cow's milk and water. From those who did not have exclusive breastfeeding for 6 months, the minimum age of starting additional feeding was 1 month and the maximum was 5 months, the mean being 2 months. Majority of the mothers (96%) reported they were breastfeeding more than 8 times per day, but 4% reported they were breastfeeding less than 8 times per day.

Association of KMC Practice with Exclusive Breastfeeding Practice

Exclusive breastfeeding was found to be significantly associated with the age of KMC initiation and the age of KMC discontinuation. Infants who were started on KMC within 24 hours of life were 3.8 times more likely to be exclusively breastfed than those who started KMC after 24 hours of age (P value = 0.04, CI 1.07–13.25). Infants who were provided with KMC for greater than or equal to the mean age (≥ 56 days) were also observed to be on exclusive breastfeeding 4.2 times more than those who were provided with KMC for less than 56 days (P value = 0.00, CI 1.62–11.01) (Table 4).

Anthropometric Measurements of the LBW Infants

Growth parameters (weight for age, length for age, weight for length, and head circumference for age) were assessed using the standard WHO growth curves to their corrected age using the Z score. Malnutrition was observed in 12(75%) and 38(46.3%) infants who were born $<$ and ≥ 1500 grams, respectively (Figure 2). The incidence of underweight,

Table 4 Association of KMC Practice with Exclusive Breastfeeding Among LBW Infants Discharged from ACSH and Mekelle General Hospital from June 1, 2017 to February 30, 2018

Variables		Exclusive Breast Feeding		COR (95% CI)	P-value	AOR (95% CI)	P-value
		No (%)	Yes (%)				
Age at KMC initiation	≤ 24 hours	4(19%)	17(81%)	2.90(0.88–9.55)	0.08	3.77(1.074–13.25)	0.04
	>24 hours	28(40.6%)	41(59.4%)	I		I	
Age of KMC discontinuation	≥56 days	10(20.9%)	39(79.6)	2.6(1.08–6.23)	0.00	4.22(1.62–11.00)	0.00
	<56 days	24(57.1%)	25(51%)	I		I	

stunting, wasting, and having small head were found to be 33%, 40%, 17%, and 7%, respectively. The severe form of underweight, stunting, wasting and microcephaly were found in 11%, 25%, 5% and 1% of the infants, respectively.

Association of Malnutrition with Other Variables

The relationship of malnutrition with birth weight, weight for gestational age, duration of KMC per day, age at KMC discontinuation, and mothers' support during KMC was assessed in this study. Infants who were born <1500 grams were found to be 7.3 times more likely to have malnutrition than those with birth weight ≥1500 grams ($P = 0.01$, CI 1.63–32.59) and infants who were born small for gestational age were 4.8 times more likely to be malnourished than those of appropriate for gestational age ($p = 0.01$, CI 1.41–16.31). Infants who were provided with KMC for less than 8 hours per day were 4.5 times more likely to be malnourished than those who were provided more than 8 hours per day ($P=0.01$, CI 1.40–16.31)). Infants whose mothers were not assisted by other family members to provide KMC at home were 3.8 times more likely to be malnourished than those who were assisted ($P=0.01$, CI 1.30–10.85). Infants who discontinued KMC before 56 days of age were found to be 6.2 times more likely to have malnutrition than those who were provided for more than 56 days of age ($P=0.00$, CI 2.15–17.77) (Table 5).

Developmental Milestones

Data were gathered on developmental milestones using interviewer-guided structured questionnaire about social smiling, sitting unsupported, crawling, standing unsupported, and saying either “baba” (“dada”) or “mama” and the age of onset

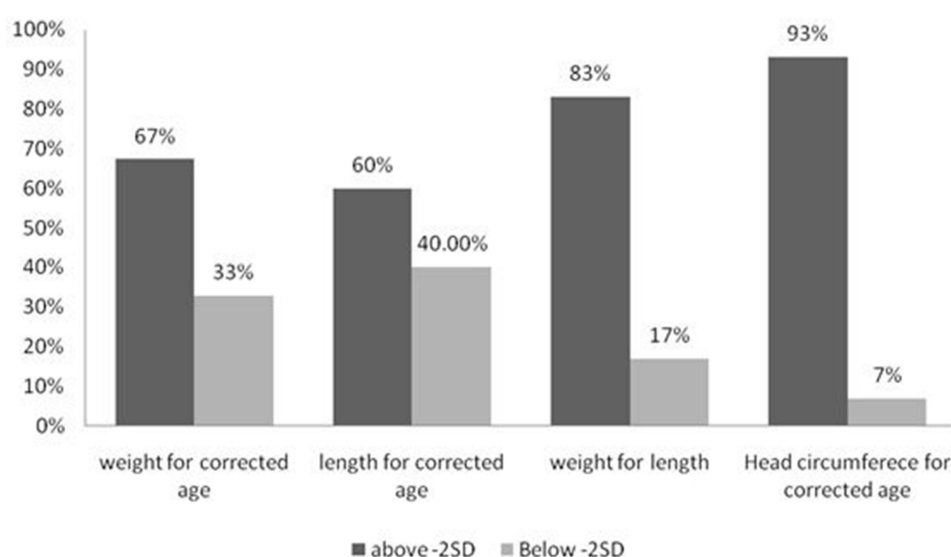
**Figure 2** Growth outcomes of LBW infants discharged from ACSH and Mekelle General Hospital from June 1, 2017 to February 30, 2018.

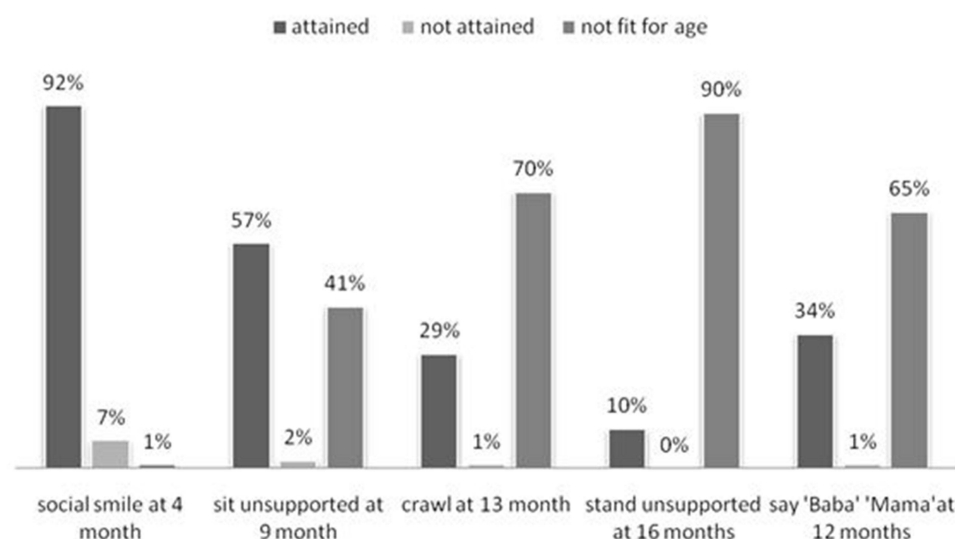
Table 5 Association of Variables with Malnutrition Among Infants Discharged from ACSH and Mekelle General Hospital from June 1, 2017 to February 30, 2018

Variables		Anthropometry		COR (95% CI)	P value	AOR (95% CI)	P value
		Normal (%)	Malnutrition (%)				
Birth weight	<1500 grams	4(25)	12(75)	3.47(1.03–11.67)	0.04	7.30 (1.63–32.59)	0.01
	≥1500 grams	44(53.7)	38(46.3)	I		I	
Birth weight for GA	SGA	10(34.5)	19(65.5)	2.33(0.95–5.73)	0.07	4.79(1.41–16.31)	0.01
	AGA	38(55.1)	31(44.9)	I		I	
Maternal parity	Multipara	29(49.6)	36(55.4)	1.69(0.72–3.93)	0.23	1.45(0.50–4.21)	0.50
	Primipara	19(57.6)	14(42.4)	I		I	
Duration of KMC provided per day	<8 hours	8(26.7)	22(73.3)	3.93(1.53–10.08)	0.00	4.50(1.40–16.31)	0.01
	≥8 hours	40(58.8)	28(41.2)	I		I	
Age of KMC discontinuation	≥56 days	15(30.6)	34(69.4)	4.68(2.00–10.96)	0.00	6.18(2.15–17.77)	0.00
	<56 days	33(67.3)	16(32.7)	I		I	
Assistance of mother who provides KMC	No	11(29.7)	26(70.3)	3.64(1.32–8.72)	0.00	3.75(1.30–10.85)	0.01
	Yes	37(60.7)	24(39.3)				

reported by the mothers or caregivers were compared to WHO Multi-Centre Growth Reference Study Group standards of achievement of motor development milestones and American Academy of Pediatrics milestone checklists. Among all the study infants, 90(91.8%) have attained a social smile at 4 months within the expected age, while 7(7.1%) infants failed to attain the expected social smile for their age and one infant (1%) did not attain the expected age. Fifty-seven (57%) infants have attained sitting unsupported at 9 months but 2(2%) failed to attain sitting unsupported at that specific age and the remaining 41% did not attain the expected age for sitting unsupported. Thirty-four (34%) infants have started to say “maba” or “mama” before 12 months of age, while the remaining 65% did not attain the expected age, and 10(10%) infants were unable to stand unsupported, while 90 infants did not attain the expected age (Figure 3).

Discussion

This study was done to assess the practice of kangaroo mother care at home and to see the outcomes in terms of exclusive breastfeeding, clinical condition, and anthropometric measurements.

**Figure 3** Developmental milestones achievements of LBW infants discharged from ACSH and Mekelle General Hospital from June 1, 2017 to February 30, 2018.

KMC was continued at home in 99% of the infants, the mean age of discontinuation of KMC was 56.5 days. Continuous KMC (>20 hours) was provided for 19% of the infants and majorities (70%) were provided for more than 8 hours per day. A similar study done in Ghana among 202 mothers in 2010 showed KMC practice after discharge to be 99.5% either intermittent or continuous KMC at home.⁸ Another study done in India showed practice after discharge in 91.8% and the longest duration of practice of KMC was 13 days the average being 5 days. The average practice per day was 9 hours.⁷ A community-based pilot study that was carried out at three sites in the states of India after health education was given during ANC follow-up and postnatal period shown; all mothers practiced KMC intermittently; maximum duration (median) of practice/day was 8 hours and minimum 3 hours. The mean duration was 34.3, 44.3, and 26.1 days in the three states.¹¹ A study done in Addis Ababa Tikur Anbessa Specialized Hospital (TASH) in 2014 also showed KMC continuation at home in 84% out of 110 infants.⁶ The differences may be due to the samples in the three states of India and that of Tikur Anbessa included rural residents.

Our study described the common medical problems encountered in addition to being LBW were hypothermia, sepsis, and respiratory distress syndrome. This result is the same with a study done in Addis Ababa and in India.^{5,9}

In this study, 97(96%) mothers reported that there was no challenge during the practice of KMC but 4 mothers (4%) mentioned challenges in practicing like back pain and discomfort during the night, feeling hot during the practice, and having cesarean delivery makes it difficult to practice KMC. Similar responses were observed in the community study done in India mentioned above, which showed most (94.7%) mothers experienced no difficulty while practicing KMC; 5.2% mothers reported back pain during KMC while sitting for a longer time in one place; pain in the body, neck, knee, hand; cough, fever, and weakness were common problems.¹¹ Another study done in India (Gujarat) showed that back pain, stitch or C/S pain and behavioral change were the common problems and account for 20%, 6.7%, and 1.6%, respectively.¹⁰

In our study, 30% of the infants had unscheduled hospital visits and 14(47%) needed re-admission and respiratory problems accounted for 93% of the admissions. Similarly, in the study done in Tikur Anbessa Specialized Hospital, 36.4% of the study populations had unscheduled hospital visits and out of them, 20% need re-admission. The most common causes of admissions also included respiratory infections.⁶ The other study done in India also showed fast breathing, cold to touch, yellow skin, sticky eyes, vomiting after feeds and poor sucking as some of the infant's problems reported.¹¹

In our study, there were 3% deaths reported, which is similar to a study done in India (Gujarat) (3.4%) and lower than the 9% deaths reported from TASH. The difference between the two studies might be explained possibly because of the difference in the study subjects, where the TASH study was done among very low-birth-weight infants in which mortality may be higher, and 36% of the deaths were from rural areas and this might account for higher deaths due to delay or lack of access to health service. But the causes of death were similar – respiratory problems.^{6,10}

In this study, 61% of the mothers were given support for KMC by different family members – husbands (24%), aunts (18%), and grandmothers (13%) – who were involved in giving KMC practice post-discharge. A similar study in Ethiopia revealed that mothers who had been supported by their husbands were more likely to practice KMC at home. Paternal involvement played a considerable role in the practice of KMC at home.²⁰

As to the time of interview, 65% of the infants were reported to be on exclusive breastfeeding and it was found significantly associated with the age of KMC initiation and age of discontinuation of KMC. Exclusive breastfeeding was found 3.8 times higher among the infants who started KMC within 24hrs than those who started after 24hrs and 4.2 times higher among infants who discontinued after 56 days of age than those who discontinued after 56 days of age. Similarly in the study done in TASH on assessment of exclusive breastfeeding among mothers on KMC, exclusive breast was observed in 55.9% of the mothers who practiced KMC at home; mothers who started KMC immediately were 2.3 times more likely to practice exclusive breastfeeding than those who started after 24 hours; mothers who were practicing continuous KMC at home were 14 times more likely to practice exclusive breastfeeding.⁹ Another study done in Madagascar also showed that the proportion of exclusive breastfeeding was higher in infants who start KMC within 24 hours than those who started after 24 hours of age.^{12,16}

In the anthropometric measurements, the incidence of being underweight, wasting, stunting and having a small head for their corrected age (a moderate form of malnutrition lie below - 2Z score) in the study subjects were 33%, 40%, 17%,

and 7% respectively, while in a study done in India among very low-birth-weight infants, the assessment of growth on 6 month–1yr corrected age showed the incidence of underweight, wasting, stunting and small head to be 47.7%, 34.1%, 22.7%, and 18.2% respectively in the KMC groups. The study was a randomized controlled trial, but the intervention given was KMC similar to this study subjects. The growth assessment was more or less comparable with a slight difference, which can be due to the baseline anthropometry of the study subjects, which were all very-low-birth weight infants.¹³

Dawar et al described that 88.3% of the mothers who completed the 4 weeks post-discharge visit were breast-feeding and practicing skin-to-skin contact. Infant growth measures were not analyzed for significance; however, there were positive gains in weight, length, and head circumference.²¹ In our study, infants who were provided KMC for a prolonged duration per day and on whom KMC was discontinued late, the incidence of malnutrition was low. This is in line with a prospective follow-up cohort study conducted in India that reported that the duration of KMC was found to be the most common determinant for intensified growth for LBW.²⁰

The weight for corrected age was normal for 67% of the infants, which is similar in a cohort study done in Brazil at 6 months of life that showed 68.4% of LBW infants provided KMC in hospital and home had corrected weight for gestational age between 15th and 85th percentile of the World Health Organization (WHO) weight curve.¹⁴

In the assessment of achievement of developmental milestones the WHO windows of achievement of six gross motor developmental milestones were used as a standard of comparison to assess the sitting unsupported, crawling, and standing unsupported; and the American Academy of Pediatrics checklists for emotional and language development was used as a reference of achievement for the social smile and saying “mama” or “dada”. In this study, there were 92% of the infants who develop their milestones of social smile at expected/corrected age; this is similar with the study done in Brazil on the responses on testing smiling on social contact in the third month of corrected age of 105 preterm newborn was 94.3%.¹⁵ Of the 59 infants who reach 9 months of age, 57 (96.6%) of them develop their milestone (sitting unsupported) at the expected age, whereas 2(3.3%) fail to achieve the milestone and develop developmental delays. This means KMC has a beneficial effect on the neurodevelopmental outcome of low-birth-weight babies, which is similar with a study done by Doddabasappa et al.¹⁶ But 91 (90%) infants did not attain the expected age for evaluation of standing unsupported, this makes it difficult to assess complete incidence of developmental delay because of the early age evaluation. In a study done in the Netherlands on motor development of premature infants, early age evaluation did not show to have significant predictive value and they suggested long-term follow-up to assess development.^{17–19}

Conclusion

Almost all of the mothers practiced KMC at home for more than 8 hours per day with exclusive breastfeeding and mortality was only 3%. KMC improves growth in low-birth-weight and preterm infants and has an important role in protecting from infection and hypothermia as well as promoting exclusive breastfeeding. Malnutrition was found in almost half of the study subjects, and it was high among those who were very low birth weight and were Small for Gestational Age. It was observed to be low in the infants who were provided KMC for a prolonged duration per day, on whom KMC was discontinued late, and whose mothers were assisted by other family members providing KMC. In most of the studies, infants attained the developmental milestones expected for their age.

Recommendation

Mothers or caregivers should be advised to practice KMC for a prolonged duration daily and extended length of days at home to improve the outcome of the LBW infants.

Definitions of Terms

Practice of KMC: is the early and continuous skin-to-skin contact between the mother or caregiver or substitute and her baby in a hospital and after discharge with exclusive breastfeeding.

Continuous KMC: providing KMC day and night without interruption except for changing diapers and bathing the baby or for toilet and showering of the mother.

Intermittent KMC: providing KMC with interruptions, in addition to changing diapers and bathing the baby or for toilet and showering the mother.

Outcome: readmission, mortality, exclusive breastfeeding, growth, and developmental milestones of the infants in the study.

Exclusive breast feeding: providing only breast milk without any additional feeding including water.

Malnutrition (underweight, wasting, stunting): weight for age, weight, for length or length for age lies below the $-2Z$ score on the WHO growth curve.

Severe malnutrition (severe wasting, severe stunting): weight for age, weight for length, or length for age lies below the $-3Z$ score on the WHO growth curve.

Small head and microcephaly: head circumference for age lies below $-2Z$ and $-3Z$ score on the WHO growth curve, respectively.

Abbreviations

ACSH, Ayder Comprehensive Specialized Hospital; AGA, appropriate for gestational age; CS, caesarean section; CMC, Conventional Method of Care; HEW, health extension worker; KMC, kangaroo mother care; LBW, low birth weight; NICU, Neonatal Intensive Care Unit; PICU, Pediatrics Intensive Care Unit; SD, standard deviation; SGA, small for gestational age; SPSS, Statistical Package for the Social Sciences; SSC, skin-to-skin contact; VLBW, very low birth weight; TASH, Tikur Anbessa Special Hospital; WHO, World Health Organization.

Data Sharing Statement

The data is included in the manuscript and will be available based on the request.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors declare that they have no competing interests in this work.

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