Breastfeeding Characteristics of Late-Preterm Infants in a Kangaroo Mother Care Unit

Melissa Pike (BCommunication Pathology)

Alta Kritzinger (DPhil)

Esedra Krüger (MCommunication Pathology)

University of Pretoria

Word count: Abstract (237), Text (3040)

Number of tables and figures: 4 Tables, 0 figures

Address for correspondence and re-prints:

Department of Speech-Language Pathology and Audiology

University of Pretoria

Lynnwood Road

Hatfield

Pretoria

Private bag X20

Hatfield 0028

Contact details:

Email: pikemelissa2@gmail.com

Cellphone: +2773 431 5422

Fax: +2786 672 5037

Abstract

Objective: To describe the breastfeeding characteristics of late-preterm infants (LPIs) in a kangaroo mother care (KMC) unit .

Materials and methods: In a 20-bed KMC unit, the breastfeeding of 73 purposively-selected LPIs' (mean gestational age: 34.8 weeks) was observed once-off, using the Preterm Infant Breastfeeding Behavior Scale. Participants' mean age was 9.5 days, mean number of days in the unit was 3.1 days, and mean number of days breastfeeding was 7.5 on observation.

Results: Only 13.7% of participants were directly breastfeeding without supplementary tube-feeding/cupfeeding and 86.3% received supplementary cup-feeding of expressed breast milk. Most participants did not exhibit obvious rooting (83.5%) and although most latched-on (97.3%), those who did, latched shallowly (93%). The mean longest sucking burst was 18.8 (SD: 10.5) and approximately half the participants swallowed repeatedly (53.4%). The mean breastfeeding session duration was 17.8 minutes but most participants breastfed less than 10 minutes (76.7%). No statistically significant associations were found between chronological age and breastfeeding characteristics. A general trend towards more mature behaviors in participants breastfeeding for more days was present for many breastfeeding characteristics. More infants exhibited the most mature behavior for each breastfeeding characteristic when the environment was quiet, rather than noisy and disturbing, except for depth of latching (quiet: 0%, disturbance: 15.2%).

Conclusion: LPIs in this sample presented with subtle breastfeeding difficulties, highlighting their need for breastfeeding support. Further research is required to examine the effect of KMC on breastfeeding in LPIs.

Keywords: Breastfeeding characteristics; kangaroo mother care; late-preterm infants

List of acronyms and abbreviations:

Baby Friendly Hospital Initiative (BFHI)

Gestational age (GA)

Human immunodeficiency virus (HIV)

International Business Machines Statistical Package for Social Sciences (IBM SPSS)

Inter-rater reliability (IRR)

Kangaroo Mother Care (KMC)

Late-preterm infant (LPI)

Mean (M)

Neonatal intensive care unit (NICU)

Post menstrual age (PMA)

Preterm Infant Breastfeeding Behavior Scale (PIBBS)

Speech-language therapist (SLT)

Standard deviation (SD)

Introduction

Late-preterm infants (LPIs), or those born between 34 and 36 weeks and six days gestational age (GA), have become a population of increased research interest since their vulnerabilities have been recognized. Feeding difficulties are one of the complications found to be more prevalent in this population than in term infants,[1] and are one of the primary reasons for delays in discharge, and hospital readmission of these infants.[1,2]

LPIs may be at risk for feeding difficulties for several reasons.[3] Firstly, LPIs are still physiologically and neurologically immature.[4] Secondly, various morbidities associated with late-preterm birth may negatively impact on feeding, such as hyperbilirubinemia, hypoglycemia, respiratory difficulties, and dehydration.[1,5,6] LPIs are more likely than term infants to be separated from their mothers for medical investigations and treatments.[3,7] Avoiding separation, as in kangaroo mother care (KMC) has a positive impact on breastfeeding and breast milk production.[8] KMC appears important in this population, as lower rates of breastfeeding exclusivity and decreased breastfeeding duration are found in LPIs than in term infants.[9–12] This is concerning, as the global standard is exclusive breastfeeding for the first six months of life.[13]

While research suggests that breastfeeding difficulties are important to consider in LPIs, literature is limited regarding specific breastfeeding characteristics of LPIs.[14] Publications highlighting breastfeeding characteristics specific to LPIs,[5,7,15,16] do not appear to be based on original research, but rather on clinical experience; or are now

older than 10 years. In addition, limited research is available regarding LPIs breastfeeding in KMC, an intervention known to promote breastfeeding.[8]

Increased knowledge of specific breastfeeding characteristics may be useful in early identification, and intervention for breastfeeding difficulties that may place LPIs at risk for the negative cyclic implications that poor breastfeeding has on milk intake, infant physiological status, maternal anxiety and milk supply.[7,10,14,17–20] Consequently, further investigation of the breastfeeding characteristics of LPIs receiving KMC, is required. This was the aim of this study.

Materials and methods

Institutional ethical clearance was obtained to conduct this descriptive, prospective, observational study. Prospective data collection took place in an established KMC unit in a South African academic hospital, where 20 mothers lodge in an open-dormitory, providing intermittent or continuous KMC to their infants. The KMC unit accepts healthy, low-birth weight and premature infants, and full-term infants with feeding difficulties, from high care and the neonatal intensive care unit (NICU). Infants should typically have established oral feeding on admission into the unit. The Baby Friendly Hospital Initiative (BFHI)[21] is implemented. Providing supplementary expressed, and occasionally donor, breast milk via cup at three-hourly feeding times in the unit ensures adequate milk intake. Direct breastfeeding is also practiced in human immunodecifiency virus (HIV) exposed infants, as HIV positive mothers are on anti-retroviral treatment during pregnancy and after birth, and their infants are placed on

treatment from birth. If the mother's HIV viral load is high, pasteurization of expressed breast milk will take place.

Participant description

Non-probability, convenient sampling was used to select 73 LPIs (34 0/7 to 36 6/7) in a KMC unit. Infants not breastfeeding for reasons other than poor breastfeeding were excluded. To provide a holistic view of LPIs in a KMC unit, infants with morbidities were not excluded.

Participants had a mean GA of 34.8 weeks according to the New Ballard Score,[22] independently scored by neonatologists working in the unit. Sixty-six percent of the sample (n=48) were male. Participants had a mean birth weight of 2.12kg (Standard Deviation [SD]: 0.4) and mean current weight of 2.10kg (SD: 0.4). Participants' mean chronological age was 9.5 days (SD: 9.1, Range: 2-55, positively skewed: 2.9) and the mean NICU stay duration was six days (SD: 7.6, Range: 0-41).The wide range in chronological age and NICU stay duration is due to the KMC unit accepting infants only when healthy and feeding orally. Participants had been in the KMC unit for an average of 3.1 days (SD: 2.6, Range: 1-14) and had been breastfeeding for an average of 7.5 days (SD: 6.7, positively skewed: 2.8). The mean maternal age was 29 years (SD: 7.3, Range: 16-43), with 57% of mothers having at least a secondary level of education, and 64% living in informal housing.

Many participants presented with factors that could potentially influence breastfeeding, including being one of a twin (35.6%), cesarean section delivery (61.6%), HIV exposure (27.4%), bronchopulmonary dysplasia (1.4%), transient tachypnea of the

newborn (19.2%), patent ductus arteriosus (13.7%), respiratory distress syndrome (46.6%), small for gestational age/intra-uterine growth restriction (31.5%), hyperbilirubinemia (67.1%), congenital disorders (6.8%) and craniofacial anomalies (6.8%).

Data collection

Mothers provided voluntary informed consent (in English, Sepedi or isiZulu). Background information was collected by medical file review and maternal interview. The Preterm Infant Breastfeeding Behavior Scale (PIBBS),[16] was then completed following observation of one entire breastfeeding session. This validated tool, which the authors found had good inter-rater reliability (IRR), guides observations of preterm infants' breastfeeding.[16] It sets out maturational steps for each breastfeeding characteristic, from immature, to mature term behaviors.[16] The checklist was completed by speech-language therapists (SLT), not mothers, as intended by the authors of the PIBBS, as not all mothers were English-speaking.

Training in using the PIBBS took place between two SLTs, and 22 participants' breastfeeding sessions were jointly observed by both SLTs for IRR assessments. Cohen's Kappa values for five PIBBS items ranged from poor to very good,[23] including latching-on (0.46, agreement: 76%), sucking (0.74, agreement: 85%), swallowing (0.37, agreement: 67%), dull, glazed, open eyes (1.0, agreement: 100%), open eyes, active movements (1.0, agreement: 100%) and the letdown reflex (-0.07, agreement: 86%). Given these varying values, joint review of all 22 participants' results with a third SLT, took place to reach a consensus. Reasons for discrepancies, such as differing levels of

visibility of the throat and mouth by two raters, were discussed and criteria for observations of subsequent sessions by one rater were established.

Data analysis

Data were analyzed using IBM SPSS (Version 24). Cohen's Kappa Measure of Agreement was used to determine IRR. Descriptive statistics were calculated and statistically significant differences and associations were determined using the Fisher's exact test and chi-squared test procedures. The Spearman's correlation coefficient was determined for ordinal data. P-values of 0.05 were determined statistically significant.

Results

Of the 73 participants, 97.3% were on full oral feeds (cup-feeding and/or breastfeeding) at the time of data collection and had been for a mean of 7.2 days (SD: 7.2, positively skewed: 2.8). Most participants (72.6%) began breastfeeding on the day of birth, but only 13.7% were directly breastfeeding without supplementary cup-feeding or tube-feeding. Up to 26% of participants required several days of tube-feeding (M: 6.3, SD: 5.9) and 86.3% received cup-feeding of breast milk (M: 6.0 days, SD: 7.3) to supplement breastfeeding. Few mothers (5.5%) had lactation difficulties.

Table 1 indicates the breastfeeding characteristics exhibited by participants as a group, and when divided into three chronological age-groups. Breastfeeding characteristics are based on test items of the PIBBS. For the sake of clarity, in the present study, the test item 'how much of the breast was inside the baby's mouth' is referred to as depth of latching, and 'latching-on and staying fixed to the breast' is referred to as latching duration. According to the PIBBS,[16] mature behaviors are

obvious rooting, latching onto the nipple and some areola, latching-on for long durations, long sucking bursts and repeated swallowing.[16] Based on this classification, no participant exhibited the most mature behavior for every breastfeeding characteristic. Less than 50% of participants exhibited the most mature behavior for each breastfeeding characteristic according to the PIBBS, with the exception of repeated swallowing (53.3%). Most participants did not exhibit obvious rooting (83.5%). Most participants latched-on (97.3%), but those who did, latched shallowly (93%) and for less than five minutes (76.1%). Approximately half the participants exhibited long sucking bursts (46.6%), with a mean longest burst of 18.8 sucks, with considerable variation (SD: 10.5). Approximately half the participants exhibited repeated swallowing (53.4%), the other half swallowing occasionally (34.3%) or not at all (12.3%). Participants were held for breastfeeding for a mean of 17.8 minutes (SD: 4.6, positive skewness: 1.0) but most were held for under 10 minutes (76.7%).

Table 1. Breastfeeding characteristics according to chronological age-groups (n=73)

				Chronological age (days)			Significance		
Breastfeeding characteristics	Descriptive		Overall (%)	1-7 (%)	8-14 (%)	15+ (%)	Fisher's exact	Spearman's correlation coefficient	P-value
Overall			73 (100.0)	37 (50.7)	25 (34.2)	11 (15.1)			
Rooting									
None	N/A		26 (35.6)	13 (35.1)	11 (44.0)	2 (18.2)	0.366	0.096	0.424
Some			35 (47.9)	19 (51.4)	11 (44.0)	5 (45.4)			
Obvious			12 (16.5)	5 (13.5)	3 (12.0)	4 (36.4)			
Depth of latching									
None	N/A		2 (2.8)	1 (2.7)	1 (4.0)	0 (0.0)	0.517	0.215	0.065
Part nipple			21 (28.8)	14 (37.8)	6 (24.0)	1 (9.1)			
Whole nipple			45 (61.6)	20 (54.1)	16 (64.0)	9 (81.8)			
Some areola			5 (6.8)	2 (5.4)	2 (8.0)	1 (9.1)			
Latching duration (min)									
None	*Mean**	*4.6*	2 (2.7)	1 (2.7)	1 (4.0)	0 (0.0)	0.807	0.002	0.986
<1min	*SD*	*3.2*	9 (12.3)	6 (16.2)	2 (8.0)	1 (9.1)			
1-5	*Skewness*	*1.5*	45 (61.6)	20 (54.1)	18 (72.0)	7 (63.6)			
6-10	*Kurtosis*	*2.6*	14 (19.2)	7 (18.9)	4 (16.0)	3 (27.3)			
≥ 11			3 (4.2)	3 (8.1)	0 (0.0)	0 (0.0)			

Sucking									
None	N/A		2 (2.7)	1 (2.7)	1 (4.0)	0 (0.0)	0.553	0.108	0.127
Licking			3 (4.1)	3 (8.2)	0 (0.0)	0 (0.0)			
Single sucks			14 (19.2)	7 (18.9)	6 (24.0)	1 (9.1)			
Short bursts			20 (27.4)	12 (32.4)	4 (16.0)	4 (36.4)			
Long bursts			34 (46.6)	14 (37.8)	14 (56.0)	6 (54.5)			
Longest sucking burst (number of sucks)**									
1-5	*Mean*	*18.8*	10 (14.7)	6 (18.1)	3 (12.5)	1 (9.1)	0.445	0.129	0.288
6-10	*SD*	*10.5*	12 (17.6)	5 (15.2)	5 (20.8)	2 (18.2)			
11-15	*Skewness*	*-0.2*	8 (11.8)	5 (15.2)	2 (8.3)	1 (9.1)			
16-20	*Kurtosis*	*-1.6*	5 (7.4)	2 (6.1)	1 (4.2)	2 (18.2)			
21-25			5 (7.4)	5 (15.2)	0 (0.0)	0 (0.0)			
≥ 26			28 (41.1)	10 (30.2)	13 (54.2)	5 (45.4)			
Swallowing									
None	N/A		9 (12.3)	6 (16.3)	3 (12.0)	0 (0.0)	0.369	0.216	0.071
Occasional			25 (34.3)	14 (37.8)	9 (36.0)	2 (18.2)			
Repeated			39 (53.4)	17 (45.9)	13 (52.0)	9 (81.8)			
Length of time baby was held for breastfeeding (min)									
1-5	*Mean*	*17.8*	29 (39.7)	17 (45.9)	9 (36.0)	3 (27.3)	0.474	0.112	0.353
6-10	*SD*	*4.6*	27 (37.0)	11 (29.7)	12 (48.0)	4 (36.3)			
11-15	*Skewness*	*1.0*	13 (17.8)	7 (18.9)	3 (12.0)	3 (27.3)			
16-20	*Kurtosis*	*0.9*	3 (4.1)	2 (5.5)	1 (4.0)	0 (0.0)			
≥ 21			1 (1.4)	0 (0.0)	0 (0.0)	1 (9.1)			

*Descriptive data for latching duration excludes infants latching <1 min
**n<73 as not all infants sucked

No statistically significant relationships between chronological age and breastfeeding characteristics were found. However, a trend towards a higher percentage of older participants exhibiting mature behaviors could be seen for most breastfeeding characteristics, including rooting, depth of latching, sucking and swallowing. Results of latching duration, longest sucking burst and length of time held for breastfeeding did not show clear trends.

Table 2. Breastfeeding characteristics in relation to mean number of days breastfeeding (n=73)

Breastfeeding characteristic	Frequency (%)	Mean no. days breastfeeding (SD)
Rooting		
Not obvious/none	61 (83.6)	6.9 (5.3)
Obvious	12 (16.4)	10.3 (11.3)
Depth of latching		
Whole nipple/less	68 (93.2)	7.4 (6.7)
Some areola	5 (6.8)	8.0 (6.1)
Latching duration (min)		
<15	71 (97.3)	7.6 (6.7)
≥ 15	2 (2.7)	4.0 (0.0)

Sucking		
Short bursts/less	39 (53.4)	6.7 (5.6)
Long bursts	34 (46.6)	8.3 (7.7)
Longest sucking burst (number of sucks)		
<30	48 (65.6)	6.8 (5.2)
≥30	25 (34.4)	8.8 (8.7)
Swallowing		
Occasional/none	34 (46.6)	5.8 (4.7)
Repeated	39 (53.4)	9.0 (7.7)
Length of time baby was held for breastfeeding (min)		
<15	67 (91.8)	7.6 (6.9)
≥15	6 (8.2)	6.3 (2.7)

Table 2 shows similar results. Participants that exhibited the most mature behaviors according to the PIBBS classification, had on average, been breastfeeding for longer than those exhibiting less mature behaviors, except for latching duration. Infants with more experience breastfeeding tended to breastfeed for shorter durations.

Table 3. General behavior during breastfeeding

General behaviour	Frequency(%)*
Closed eyes, no movements	58(79.5)
Cried, fussed audibly	21(28.8)
Open eyes, dull/glazed look	15(20.5)
Closed eyes, active movements	14(19.2)
Drowsy, open eyes, heavy-lidded	13(17.8)
Eyes wide open, achieved eye contact	4(5.5)
Open eyes, active movements	4(5.5)
Eyes wide open, looked tense/afraid	1(1.4)

*Total % > 100 as participants exhibited >1 behavior

The letdown reflex was perceived in 98.6% of mothers and no breast problems were reported. The participants' general behavior varied, with many infants exhibiting several behaviors during one breastfeeding session (Table 3).

The influence of environment on breastfeeding characteristics is depicted in Table 4. When the environment was quiet and private, rather than disturbing, more infants exhibited the most mature behavior for each breastfeeding characteristic, except

for depth of latching. Participants breastfeeding when the environment was quiet tended to be held for breastfeeding for longer.

Table 4. Breastfeeding characteristics in relation to the environment (n=73)

		Influence of the environment	
Breastfeeding characteristic	Overall (%)	Some disturbance (%)	Quiet/private (%)
Overall (%)	73 (100.0)	33 (45.2)	40 (54.8)
Rooting			
Not obvious/none	61 (83.6)	31 (93.9)	30 (75.0)
Obvious	12 (16.4)	2 (6.1)	10 (25.0)
Depth of latching			
Whole nipple/less	68 (93.2)	28 (84.8)	40 (100.0)
Some areola	5 (6.8)	5 (15.2)	0 (0.0)
Latching duration (min)			
<15	71 (97.3)	33 (100.0)	38 (95.0)
≥ 15	2 (2.7)	0 (0.0)	2 (5.0)
Sucking			
Short bursts/less	39 (53.4)	18 (54.5)	21 (52.5)
Long bursts	34 (46.6)	15 (45.5)	19 (47.5)
Longest sucking burst (number of sucks)			
<30	48 (65.6)	24 (72.7)	24 (60.0)
≥30	25 (34.4)	9 (27.3)	16 (40.0)
Swallowing			
Occasional/none	34 (46.6)	18 (54.5)	16 (40.0)
Repeated	39 (53.4)	15 (45.5)	24 (60.0)
Length of time baby was held for breastfeeding (min)			
<15	67 (91.8)	33 (100.0)	34 (85.0)
≥15	6 (8.2)	0 (0.0)	6 (15.0)

Discussion

Results highlight specific breastfeeding characteristics and difficulties in this sample of 73 LPIs receiving KMC. Most participants were not exhibiting obvious rooting (83.5%), which was unexpected, as this reflex is expected from 28 weeks GA.[24] However, rooting can be influenced by reduced alertness,[25] which may have been the case in this study, as the predominant behavior while breastfeeding was closed eyes without movements (79.5%). For breastfeeding, rooting is important, as it gives an indication of feeding readiness and may impact on successful latching.[25,26] Latching was indeed affected in this sample. Although most latched-on (97.3%), latching was shallow,

only onto the nipple or less, in 93% of participants who latched-on. Poor latching, often highlighted in LPIs, [5,14,27] is concerning, as this may impact on the efficiency of milk transfer.[25]

Immaturity in sucking and swallowing were also expected, given previous research indicating that neurological immaturity in LPIs may impact on these characteristics, and that coordinating these with breathing, only matures and is refined in the third trimester.[5,14,27,28] The suck-swallow-breathe ratio for efficient breastfeeding in term infants is 1-1-1, to 3-1-1.[24] Less frequent swallowing may indicate poor milk transfer.[24] While repeated swallowing was observed in approximately half the participants (53.4%), 46.6% were not swallowing or swallowing only occasionally, and may thus not have achieved adequate milk transfer.

The majority (67.8%) of participants' longest sucking bursts were within the norms for term infants.[24] However, this mean value reflects the longest sucking burst. The average sucking burst length throughout the breastfeeding session may have been shorter, as 53.4% of participants exhibited short sucking bursts or less. Nevertheless, Nyqvist [29] states that even with short sucking bursts, preterm infants can be successful breast-feeders if milk transfer is efficient. However, results of this study suggest participants as a group may have had inefficient milk transfer, given the number of participants with shallow latching and infrequent swallowing. Infrequent swallowing may be observed if an infant is exhibiting non-nutritive sucking, rather than nutritive sucking.[26] Non-nutritive sucking creates slower milk transfer with the risk of insufficient intake if the breastfeeding session is short.[25]

Although the mean length of time held for breastfeeding was 17.8 minutes (Positive skewness: 1.0), most participants were held for breastfeeding for under 10 minutes (76.7%). Typically, breastfeeding session length is not an accurate indicator of successful breastfeeding, as this may vary considerably depending on the infant.[25] A short breastfeeding session may indicate an efficient breast-feeder, able to achieve sufficient milk intake in a short period.[25] As the results may suggest that participants as a group were not efficient breast-feeders, the shorter time held for breastfeeding may be an indication of poor endurance, a difficulty frequently highlighted in LPIs.[5,7,19] Poor endurance has also been highlighted as a difficulty in infants with respiratory difficulties, which many participants presented with,[26] also suggesting that the short time held for breastfeeding may be due to poor endurance. In inefficient feeders, this short breastfeeding session would raise concerns regarding sufficient intake by direct breastfeeding alone. Length of time held for breastfeeding may have been influenced by the mothers being aware that they would be top-up cup-feeding at a later stage. This may have contributed to shorter breastfeeding sessions, to allow time for cup-feeding. Additionally, Nyqvist[29] states that regular top-up cup-feeding may decrease milk intake at the breast, also potentially contributing to shorter breastfeeding sessions.

It was surprising that less than 55% of participants exhibited the most mature behavior for each breastfeeding characteristic, according to the PIBBS. Nyqvist et al.[16] found that 60 to 64% of LPIs exhibited the most mature behavior for each characteristic. Fewer breastfeeding difficulties were expected in this study, given the known positive-influence of KMC on breastfeeding.[8] Nyqvist et al.[16] did not specify whether infants with morbidities were included in their sample, which may explain these differing results. In

this sample, many participants presented with medical risk factors which previous research has associated with feeding difficulties.[19,30–33] Infants in the KMC unit are typically admitted for weight gain and feeding difficulties. These infants may have higher percentages of morbidity, with a resultant higher percentage of infants with feeding difficulties than would be typical of healthy LPIs immediately discharged. However, LPIs in general are more likely to present with many of these medical risk factors than term infants,[2,33] making it important that LPIs with these conditions not be overlooked. The impact of these factors on breastfeeding in LPIs requires further investigation.

Although results did not indicate statistical significance, there appeared to be a trend towards older participants exhibiting more mature breastfeeding characteristics. Additionally, all breastfeeding characteristics were more mature in infants breastfeeding for more days, with the exception of latching duration. The results of latching duration may have been influenced by the fact that only two participants latched-on longer than 15 minutes. Participants with more experience directly breastfeeding tended to breastfeed for shorter sessions, which may be an indication of better breastfeeding efficiency. Although these results should be interpreted with caution given the lack of statistical significance, the trends tentatively suggest that with time and experience (infant and maternal), the maturity of breastfeeding may improve. This is a concept supported by literature.[34,35]

The most frequent behavior exhibited by participants, was closed eyes and no movements, which may indicate sleepy or drowsy behavior, a predominant state in preterm infants.[26] This behavior is ambiguous, as deep sleep, or drowsiness, may hinder or promote breastfeeding respectively.[25] However, the second most frequently

observed behavior, crying and fussing, would clearly hinder successful breastfeeding.[25] Few participants presented with alert behaviors, which would promote successful direct breastfeeding.[25,26]

Results of this study suggest that a quiet, private environment fosters more mature direct breastfeeding characteristics, given that more participants exhibited mature behaviors for all breastfeeding characteristics, except for depth of latching, when the environment was quiet. Participants breastfeeding when the environment was quiet tended to breastfeed for longer, which may reflect the lack of disturbance in the environment. This is in line with literature that states that successful oral feeding requires adequate behavioral state organization,[26] and preterm infants are easily overstimulated by environmental disturbance.[36] The open-dormitory set-up may thus interfere with preterm infants who may have difficulty with state-regulation.

Although lactation difficulties in mothers of LPIs may impact on the success of breastfeeding,[19] few had lactation difficulties in this study, possibly associated with the positive influence of KMC and regular expressing of breast milk.[37] The letdown reflex was perceived in almost all mothers (98.6%) and no breast problems were reported. Thus, maternal factors appear not to have impacted significantly on the participants' breastfeeding.

The breastfeeding characteristics indicate subtle difficulties, which may have placed this sample of LPIs at risk for decreased milk transfer and intake by direct breastfeeding alone. A previous study found 33% of LPIs required some form of nutritional support, in addition to breastfeeding.[38] The higher percentage of infants

requiring supplementary tube-feeding (26%) and cup-feeding (86.3%) in the current study may be due to top-up cup-feeding being common in the KMC unit to ensure adequate milk intake. While this volume-driven supplementation may have increased the percentage of participants receiving cup-feeding, it nevertheless indicates a concern that direct breastfeeding alone would be insufficient. This need for supplementation in LPIs has been discussed in literature,[7,20,38] and cup-feeding specifically has been highlighted as an effective transition to direct breastfeeding in LPIs.[39] However, Nyqvist[29] states that for preterm infants, more frequent cue-based direct breastfeeding sessions may promote greater milk intake at the breast than regular scheduled direct breastfeeding with top-up cup-feeding. The author adds that cup-feeding should only be occasional.

SLTs and other healthcare professionals working with LPIs should be vigilant for subtle breastfeeding difficulties, which may typically be overlooked. Increased knowledge regarding breastfeeding characteristics may allow for more specific and individualized support for this population, such as prioritizing a quiet environment and allowing infants to ‘practice’ suckling at the nipple, even if direct breastfeeding is not yet established. Interventions such as cue-based breastfeeding sessions with occasional cup-feeding to supplement breastfeeding should be considered and further investigated.[29,39] Such interventions should be employed in order to best-support these vulnerable LPIs, who may be at risk for cognitive and behavioral difficulties well-beyond infancy.[40]

A number of study limitations should be mentioned. Firstly, the GA of participants was based on the New Ballard Score, which is not as reliable as ultrasounds for

determining GA.[22] Although observation is considered the least-invasive method of assessing breastfeeding,[16] the presence of an observer may nevertheless impact on maternal and infant behavior. Observations may also be subjective, as indicated by IRR results. An isolated breastfeeding session was observed, which may not give an indication of the average breastfeeding performance of participants.

A similar study, with a larger sample would allow for more in-depth analysis of factors impacting on breastfeeding characteristics in LPIs. Further investigation into the efficiency of milk transfer in LPIs should also take place, including investigating whether nutritive or non-nutritive sucking is their predominant sucking characteristic. Including immediately-discharged, healthy LPIs in a future study may be valuable for better generalization and evaluation of the impact of KMC on breastfeeding characteristics. Term and very premature infants can also be included to compare the level of maturity of breastfeeding characteristics. To date, no original research could be found regarding breastfeeding characteristics of LPIs receiving KMC. While results of this study highlight further investigation is still required, this study may provide exploratory information, which may serve as a basis for further research in this field.

Conclusion

In this sample of LPIs in a KMC unit, participants exhibited specific breastfeeding characteristics and difficulties. This knowledge may allow for more individualized feeding support for this vulnerable and often-overlooked population, potentially preventing negative cyclical implications of poor breastfeeding, and unrealistic

expectations of those working with LPIs. Further research is still required to examine the effect of KMC on breastfeeding in LPIs.

Acknowledgements

Thanks go to the Pediatric Department of Kalafong Hospital, the healthcare staff, all participants' mothers and Dr Dion van Zyl, statistician, for making this study possible.

References

1. Kuzniewicz MW, Parker SJ, Schnake-Mahl A, Escobar GJ. Hospital readmissions and emergency department visits in moderate preterm, late preterm, and early term infants. *Clin Perinatol*. 2013;40:753-775.

2. Wang ML, Dorer DJ, Fleming MP, Catlin EA. Clinical outcomes of near-term infants. *Pediatrics*. 2004;114(2):372-37.

3. The Academy of Breastfeeding Medicine. ABM clinical protocol number 10: Breastfeeding the late preterm infant (34 0/7 to 36 6/7 weeks gestation). *Breastfeed Med*. 2011;6(3):151-156.

4. Shapiro-Mendoza CK, Lackritz EM. Epidemiology of late and moderate preterm birth. *Semin Fetal Neonatal Med*. 2012;17:120-125.

5. Cleaveland K. Feeding challenges in the late preterm infant. *Neonatal Netw*. 2010;29(1):37-41.

6. Gouyon JB, Iacobelli S, Ferdynus C, Bonsante F. Neonatal problems of late and moderate preterm infants. *Semin Fetal Neonatal Med*. 2012;17:146-152.

7. Radtke J V. The paradox of breastfeeding-associated morbidity among late preterm infants. *J Obstet Gynecol Neonatal Nurs*. 2012;40(1):1-21.

8. Moore E, Anderson GC, Bergman N. Early skin-to-skin contact for mothers and their healthy newborn infants. *Cochrane Database Syst Rev*. 2012;5(3):1-75.

9. Goyal NK, Attanasio LB, Kozhimannil KB. Hospital care and early breastfeeding outcomes among late preterm, early-term, and term infants. *Birth*. 2014;41(4):330-338.

10. McDonald SW, Benzies KM, Gallant JE, McNeil D, Dolan SM, Tough SC. A comparison between late preterm and term infants on breastfeeding and maternal mental health. *Matern Child Heal*. 2013;17:1468-1477.

11. Zanardo V, Gambina I, Begley C, et al. Psychological distress and early lactation performance in mothers of late preterm infants. *Early Hum Dev*. 2011;87(4):321-323.

12. Hackman NM, Alligood-Percoco N, Martin A, Zhu J, Kjerulff KH. Reduced breastfeeding rates in firstborn late preterm and early term infants. *Breastfeed Med*. 2016;11(3):119-125.

13. World Health Organization [WHO]. *Global Strategy for Infant and Young Child Feeding*. Geneva: WHO; 2003.

14. Eidelman AI. The challenge of breastfeeding the late preterm and the early-term infant. *Breastfeed Med*. 2016;11(3):99.

15. Horgan MJ. Management of the late preterm infant: Not quite ready for prime

time. *Pediatr Clin North Am*. 2015;62:439-451.

16. Nyqvist KH, Rubertsson C, Ewald U, Sjödén PO. Development of the preterm infant breastfeeding behavior scale (PIBBS): A study of nurse-mother agreement. *J Hum Lact*. 1996;12(3):207-219.

17. Demirci JR, Happ MB, Bogen DL, Albrecht SA, Cohen SM. Weighing worth against uncertain work: The interplay of exhaustion, ambiguity, hope and disappointment in mothers breastfeeding late preterm infants. *Matern Child Nutr*. 2015;11:59-72.

18. Lau C, Hurst NM, Smith EO, Schanler RJ. Ethnic/racial diversity, maternal stress, lactation and very low birthweight infants. *J Perinatol*. 2007;27:399-408.

19. Meier PP, Furman LM, Degenhardt M. Increased lactation risk for late preterm infants and mothers: Evidence and management strategies to protect breastfeeding. *J Midwifery Women's Heal*. 2007;52(6):579-587.

20. Meier P, Patel A, Wright K, Engstrom J. Management of breastfeeding during and after the maternity hospitalization for late preterm infants. *Clin Perinatol*. 2013;40(4):689-705.

21. World Health Organization [WHO]. *Baby-Friendly Hospital Initiative*.; 2009. http://www.who.int/nutrition/publications/infantfeeding/bfhi.

22. Ballard JL, Khoury JC, Wedig K, Wang L, Eilers-Welsman BL, Lipp R. New Ballard Score, expanded to include extremely premature infants. *J Pediatr*. 1991;119(3):417-423.

23. Fleiss J, Levin B, Paik MC. *Statistical Methods for Rates and Proportions*. 3rd Editio. John Wiley & Sons, Inc.; 2003.

24. Genna CW, Sandora L. Breastfeeding: Normal sucking and swallowing. In: Genna CW, ed. *Supporting Sucking Skills in Breastfeeding Infants*. 2nd Editio. Burlington: Jones & Bartlett Learning; 2013:1-48.

25. Cadwell K. Latching-on and suckling of the healthy term neonate: Breastfeeding assessment. *J Midwifery Women's Heal*. 2007;52(6):638-642.

26. Wolf L, Glass RP. *Feeding and Swallowing Disorders in Infancy: Assessment and Management*. Tucson: Therapy Skill Builders; 1992.

27. Medoff Cooper B, Holditch-Davis D, Verklan MT, et al. Newborn clinical outcomes of the AWHONN late preterm infant research-based practice project. *J Obstet Gynecol Neonatal Nurs*. 2012;41:774-785. doi:10.1111/j.1552-6909.2012.01401.

28. Giannì ML, Bezze E, Sannino P, et al. Facilitators and barriers of breastfeeding late preterm infants according to mothers' experiences. *BMC Pediatr*. 2016;16(179):1-8.

29. Nyqvist KH. Lack of knowledge persists about early breastfeeding competence in preterm infants. *J Hum Lact*. 2013;29(3):296-299.

30. Van Nostrand SM, Bennett LN, Coraglio VJ, Guo R, Muraskas JK. Factors influencing independent oral feeding in preterm infants. *J Neonatal Perinatal Med*. 2015;8:15-21.

31. Giannì ML, Sannino P, Bezze E, et al. Effect of co-morbidities on the development

of oral feeding ability in pre-term infants: A retrospective study. *Sci Rep*. 2015;5:1-8.

32. Jadcherla SR, Wang M, Vijayapal AS, Leuthner SR. Impact of prematurity and co-morbidities on feeding milestones in neonates: A retrospective study. *J Perinatol*. 2010;30(3):201-208.

33. Natile M, Ventura ML, Colombo M, et al. Short-term respiratory outcomes in late preterm infants. *Ital J Pediatr*. 2014;40:52-62.

34. White-Traut R, Pham T, Rankin K, Norr K, Shapiro N, Yoder J. Exploring factors related to oral feeding progression in premature infants. *Adv Neonatal Care*. 2013;13(4):288-294.

35. Nyqvist KH. Early attainment of breastfeeding competence in very preterm infants. *Acta Paediatr*. 2008;97:776-781.

36. Nyqvist KH. Breastfeeding preterm infants. In: Genna CW, ed. *Supporting Sucking Skills in Breastfeeding Infants*. 2nd Editio. Burlington: Jones & Bartlett Learning; 2013:171-196.

37. Briere CE, Lucas R, McGrath JM, Lussier M, Brownell E. Establishing breastfeeding with the late preterm infant in the NICU. *J Obstet Gynecol Neonatal Nurs*. 2015;44:102-113.

38. Lapillonne A, O'Connor DL, Wang D, Rigo J. Nutritional recommendations for the late-preterm infant and the preterm infant after hospital discharge. *J Pediatr*. 2013;162:S90-S100.

39. Yilmaz G, Caylan N, Karacan CD, Bodur İ, Gokcay G. Effect of cup feeding and bottle feeding on breastfeeding in late preterm infants: A randomized controlled study. *J Hum Lact*. 2014;30(54):174-179.

40. Brumbaugh JE, Conrad AL, Lee JK, et al. Altered brain function, structure, and developmental trajectory in children born late preterm. *Pediatr Res*. 2016;80(2):197-203.

Addresses and email addresses for reprint requests and correspondence

Department of Speech-Language Pathology and Audiology

University of Pretoria

Lynnwood Road

Hatfield

Pretoria

Private bag X20

Hatfield 0028

Email: pikemelissa2@gmail.com