ORIGINAL ARTICLE

Breastfeeding progression in late preterm infants from birth to one month

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Abstract

This study aimed to describe and compare breastfeeding progression, infants' feeding behaviours, maternal feeding difficulties, and mothers' usage of breastfeeding interventions for singleton late preterm (LPT) and term infants. A further aim was to identify associated factors for exclusive breastfeeding at breast at 1 month in LPT infants. This was a cohort study where mothers of LPT infants from a neonatal unit ($n = 60$), LPT infants from a maternity unit ($n = 62$), and term infants from a maternity unit ($n = 269$) answered a questionnaire approximately 1 month after delivery. Findings showed no significant differences in exclusive breastfeeding at breasts between LPT infants admitted to the neonatal unit compared with the maternity unit, during the first week at home (38% vs. 48%), or at 1 month of age (52% vs. 50%). Term infants were more likely to be exclusively breastfed at the breast (86% and 74%, $p < 0.05$) compared with LPT infants. Multiple regression analysis showed that usage of a nipple shield, not feeding breast milk exclusively during the first week at home, or feeding less than 10 times per day at 1 month were statistically significant for not exclusively breastfeed at the breast. A protective factor was the mothers' experience of having an abundance of milk during the first week at home. In conclusion, LPT infants are less likely to be exclusively breastfed at the breast than term infants, highlighting the need for further research to guide interventions aimed at optimising exclusive breastfeeding rates.

KEYWORDS

breastfeeding pattern, exclusive breastfeeding, late preterm infants, maternity unit, neonatal intensive care unit, nipple shields

1 | INTRODUCTION

Late preterm infants (34 + 0–36 + 6) have been increasingly recognised by clinicians and researchers as a vulnerable group of infants. Late preterm (LPT) infants have increased risks for short-and long-term negative outcomes, such as hypoglycaemia, weight loss, jaundice, readmission to hospitals, neuro-developmental delays, morbidity, and mortality (Engle, Tomashek, & Wallman, 2007; Kugelman & Colin, 2013), compared with term infants. Furthermore, LPT infants constitute 75% of the preterm population, and although they have

lower risks compared with those born more preterm, the burden of caring for LPT infants, both for families and for the health care system, is large.

Given the known short- and long-term consequences of LPT births and the maternal and infant health benefits of breastfeeding (Victora et al., 2016), it is a concern that several studies have reported lower rates of breastfeeding initiation and a shorter duration of breastfeeding in LPT infants not only compared with term infants (Ayton, Hansen, Quinn, & Nelson, 2012; Demirci, Sereika, & Bogen, 2013; Donath & Amir, 2008; Goyal, Attanasio, & Kozhimannil, 2014; Hackman, Alligood-Percoco, Martin, Zhu, & Kjerulff, 2016; Rayfield, Oakley, & Quigley, 2015), but also compared with more preterm infants (Jang, Lee, & Kim, 2012). There are numerous possible reasons for these differences in breastfeeding, for example, maternal health problems, delayed maternal lactogenesis, infants' medical problems, and immaturity. The hospital organisation of care, that is, where the LPT infant is cared for and related practices, may also be hindrances to breastfeeding. Admission to a neonatal intensive care unit (NICU) has been shown to have a positive influence on breastfeeding (Colaizy & Morriss, 2008), but another study found no influence (Kair & Colaizy, 2016). The reason for better breastfeeding outcomes for LPT infants in NICU may be related to more support and more structured breastfeeding guidance in the NICU (Escobar et al., 2005; McCormick, Escobar, Zheng, & Richardson, 2006) whereas a potential negative influence could be that mothers of LPT infants in maternity units are given mismatching information and care intended for term infants (Radtke Demirci, Happ, Bogen, Albrecht, & Cohen, 2015). In the NICU, many breastfeeding interventions such as test-weighing and usage of nipple shields are used to facilitate breastfeeding of preterm infants (Ahmed & Sands, 2010; Meier et al., 2000). However, the use of some of these interventions is controversial, as the evidence base is weak, and studies conducted on both term and preterm infants have shown negative effects, such as reduced breastfeeding self-efficacy and shorter duration of breastfeeding (Geraghty, Khoury, & Kalkwarf, 2005; Jiang et al., 2015; Keemer, 2013; Kronborg, Foverskov, Nilsson, & Maastrup, 2017). Evaluations of interventions for breastfeeding the LPT infants have mainly been conducted in NICU settings with LPT infants as a part of a preterm population and without comparison with term infants or LPT infants in maternity wards (Cartwright, Atz, Newman, Mueller, & Demirci, 2017).

The first days and weeks after birth are an important and delicate time in breastfeeding establishment. Research has shown that up to 92% of new mothers experience a variety of breastfeeding problems during the first weeks (Wagner, Chantry, Dewey, & Nommsen-Rivers, 2013), whose association with early cessation is well known (Berridge, McFadden, Abayomi, & Topping, 2005; Taveras et al., 2003). However, there is a lack of knowledge on how the breastfeeding process in mothers of LPT infants differs from that of term infants and whether the process is different depending on the setting (i.e., NICU or maternity unit). The aim of this study was to describe and compare the breastfeeding progression, infants' feeding behaviours, maternal feeding difficulties, and mothers' usage of breastfeeding interventions in LPT infants from an NICU, LPT infants from a maternity unit, and

> **Key messages**
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> - Significantly fewer LPT infants were exclusively breastfed at breast than term infants, but there were no statistical significant differences between the LPT from NICU and LPT from MU.
> - Infant-feeding behaviour and maternal feeding difficulties did not differ between the two LPT groups.
> - Usage of a nipple shield, not fed breast milk exclusively at the first week at home, and fed less than 10 times per day were statistically significantly associated to not being exclusively breastfed at breast in LPT infants.
> - Findings emphasise the need for improved support to mothers of LPT infants.

term infants from a maternity unit up until 1 month of postnatal age. A further aim was to identify factors associated to exclusive breastfeeding at breast at 1 month in LPT infants.

2 | METHODS

2.1 | Design

This study was conducted as a cohort study of mothers of LPT singleton infants who were cared for in an NICU or at a maternity unit and mothers of healthy term infants. The mothers provided information at approximately 1 month after birth about their breastfeeding and experiences in the hospital during the first week at home (i.e., retrospectively) and at present (i.e., at 1 month). The data collection for this study is ongoing, and data will be collected for all dyads until 2.5 years of age.

2.2 | Setting

The setting was Landspitali University Hospital (LUH), which is the largest birth facility and the main referral hospital for high-risk pregnancies and childbirths in Iceland, where 75% of all deliveries, and about 95% of preterm (<37 weeks) deliveries occur. The only NICU in Iceland is located at the LUH, a 22-bed, level IIIb unit. All preterm infants under the gestational age of 35 weeks and with birth weight less than 2,000 g are admitted to the NICU. The NICU is open to parents 24 h a day, and by every infant's cot or incubator, there is a chair for parents. There are only two rooms for rooming-in, and hence, there are limited resources for mothers to room-in with their infant. LPT infants born ≥35 gestational weeks without medical problems are cared for at the maternity unit where they room-in with the mother. In Iceland, healthy mothers delivering at 37-42 weeks go home with their infant within 48 h from delivery and receive five to seven home visits from a midwife during the first 10 days after birth.

If an infant is born between 35 and 37 weeks and is feeding well, the mother and her infant can go home between 48 and 72 h after delivery and get the same midwifery service as term infants. For most LPT infants, the average hospital stay is 49 days, and there is no service from midwives at home. For all infants, the primary health care nurse visits the family two to four times from about 7 to 10 days after coming home until the infant is nine weeks old.

2.3 | Sample

All mothers of singleton LPT infants (34 + 0–36 + 6) that gave birth from mid-March 2015 to the end of May 2017 were invited to participate in this study. Exclusion criteria were newborns with a major congenital abnormality, Apgar of ≤6 at 5 min or clinical definition of injury to the central nervous system, and maternal age <18 years and mothers not able to speak and read Icelandic. For comparison, for every LPT infant–mother dyad, two mothers of term singletons not admitted to the NICU that met the same criteria were identified and matched (by month of infant's birth and maternal age) and were invited to participate.

During the study period, 5,972 singletons were born at the LUH, of which 259 were LPT infants. Out of the 210 mothers of LPT singletons that met the criteria for the study and were invited to participate, 153 agreed to participate (73%), and 122 mothers actually participated (58%). Out of the 405 mothers of term infants who were invited, 322 mothers agreed to participate (80%), and 269 mothers actually participated (66%). There was no difference between the mothers of LPT infants who agreed to participate and the ones actually participating in terms of maternal age, gestational age of the infant, NICU admission, and breastfeeding within 6 h after birth or breastfeeding at discharge ($p > .05$). Mothers of term infants who participated were more likely to have breastfed within 6 h after birth ($p < .05$) and to have an infant with lower gestational age in days ($p < .05$) compared with those who agreed to participate but eventually did not.

2.4 | Ethical aspects

The study was granted ethical permissions from The National Bioethics Committee of Iceland 14-051-V1, The Data protection authority 2014030541AT and from the medical director of Landspitali University Hospital (LUH) Reykjavik 16 LSH 45-14.

2.5 | Measurement

A questionnaire, Health and Well-being (HW), was developed based on literature and previously validated instruments by an interdisciplinary team of clinical experts. The HW was pretested with mothers of both LPT and term infants using cognitive interviewing (Peterson, Peterson, & Powell, 2017). The HW included questions on feeding progression (i.e., initiation and continuation of breastfeeding, exclusivity, and method); infant's feeding behaviour (i.e., sucking, stamina, awakeness, duration, and frequency of feedings and rhythm); maternal feeding difficulties (i.e., milk supply, mastitis, milk leakage, cracked nipples, and experiences of feeding); and usage of breastfeeding interventions related to breastfeeding (i.e., expressing breast milk, test-weighing, nipple shields, and pacifier). The first part of HW comprised questions about the first week at home after the birth, and the second part concerned the present situation at approximately 1 month of infant's age and where mothers were asked to consider the past 24 h.

Data on gestational age, birth weight, mode of delivery, Apgar score, singleton/twin delivery, parity, and maternal age were obtained from electronic medical/hospital records. This information was obtained after permission from the LHU medical director after the mothers agreed to participate.

In this study, our primary outcome was exclusive breastfeeding at the breast, which was defined as when the infant was given breast milk exclusively and solely at the breast. We also investigated breast milk feeding and categorised it as exclusive (i.e., only breast milk but could include medications, fortification, and vitamins); partial breast milk (breast milk in combination with formula); and no breast milk (formula feeding with no breast milk intake), all regardless of method.

2.6 | Data collection

Every 2 weeks, a list of all births at the LUH was reviewed, and mothers that met the inclusion criteria were invited to participate by mailed letters, in which they were asked to respond to an email if they wanted to participate. If mothers did not answer by email, a research assistant phoned them and invited to participate. The mothers were informed, both on the phone, in the mailed letter, and in the email, that participation in the study was voluntary and that they could withdraw at any time. Answering the questionnaire was considered to represent informed consent. The mothers that agreed to participate, by answering the email or agreeing during the phone call, were registered in Research Electronic Data Capture, and 2 weeks later, the software automatically sent out an email with the questionnaire, around the time when the infant was 1 month of postnatal age. If the questionnaire was not filled out within 5 days of receiving the email, the software automatically sent out a reminder and again after another 5 days if still no response had been recorded.

Fewer than 5% of the data were missing for all variables except for maternal education (17% among LPT), timing for first milk expression (8% among LPT), and mode of delivery (11% among term).

2.7 | Statistical analyses

Descriptive statistics are given as means with standard deviations, medians with interquartile range, or frequencies (percentages) according to the type and distribution of the data. The groups (LPT infants in the NICU, LPT infants in the maternity unit, and term infants) were compared in bivariate analyses, that is, two-sample t-tests or Pearson's chi-square tests with a two-sided 5% level of significance. To assess differences in proportions of exclusive breastfeeding at breast from 1 week to 1 month within groups, McNemar's test was used. To

identify factors associated to ceasing exclusive breastfeeding before 1 month of postnatal age in mothers of LPT infants, logistic regressions models were used. In the first step, we analysed the individual association of each of the independent variables on ceased exclusive breastfeeding at the breast in unadjusted analyses (i.e., bivariate). In the second step, all independent variables that were statistically significantly associated ($p < .05$) to breastfeeding in bivariate logistic regressions were mutually adjusted for each other (i.e., multivariate). As other factors might operate contemporaneously between variables and breastfeeding, we also needed to adjust for confounding factors. The choice of confounders entered into the model, that is, maternal education and gestational age at birth were based on theoretical assumptions as these have been shown to be important for breastfeeding duration. All results from the logistic regressions are presented as odds ratios with 95% confidence intervals. A p value less than .05 was considered statistically significant. The statistical package IBM SPSS 24.0 was used for statistical analyses.

3 | RESULTS

3.1 | Participant characteristics

The total sample consisted of 60 LPT infants cared for in an NICU (hereafter LPT NICU), 62 LPT infants cared for in a maternity unit (hereafter LPT MU), and 269 infants born at term. Characteristics of the sample by groups are reported in Table 1. The median age of the infants, when the mothers answered the questionnaire, was 46 days for LPT infants and 44 for term infants, $p > .05$.

3.2 | Breastfeeding patterns

Mothers of LPT NICU infants were less likely to initiate breastfeeding within 6 h of birth compared with mothers of LPT MU infants; 33% versus 92%, $p < .001$. Fewer mothers of LPT NICU infants, initiated breastfeeding at the hospital, compared with mothers LPT MU infants; 90% versus 100%, $p < .05$ (Table 2).

During the first week at home, there was no statistical difference between the two groups of LPT infants with regard to exclusive breast milk feeding: 63% of the LPT NICU and 56% of the LPT MU were fed breast milk exclusively. However, term infants were significantly more likely to be fed breast milk exclusively, at 86% ($p < .01$). The same pattern was seen at 1 month: there was no difference between the LPT NICU infants (58%) and LPT MU infants (53%), but both groups were fed breast milk significantly less exclusively than term infants (77%), $p < .001$ (Table 2). Mothers of LPT infants used more methods for feeding during the hospital stay and during the first week at home and were more likely to use a bottle to feed their infant at 1 month, compared with mothers of term infants (Table 2).

The proportions of exclusive breastfeeding for the LPT NICU, LPT MU, and term infants are presented in Figure 1.

There were no statistically significant differences between the two groups of LPT infants, but term infants were exclusively breastfed at the breast to a higher extent at both time points compared with LPT infants ($p < 0.01$). The change in proportion of being exclusively breastfed at the breast at 1 month compared with during the first week at home was statistically significant in term infants with a decreased rate of 12% ($p < .001$). More LPT NICU infants were exclusively breastfed at breast at 1 month compared with during the first week at home, an increase of 14%, but this was not statistically significant ($p = .07$).

3.3 | Breastfeeding interventions, infants' feeding behaviours, and feeding difficulties

There were no significant differences between mothers of LPT NICU and mothers of LPT MU with regard to breastfeeding interventions used except that mothers of LPT NICU infants were more likely to express breast milk within 6 h ($p < .05$) or to use a pacifier during the first week ($p < .001$; Table 3). There were significantly more mothers of LPT infants than term infants who indicated that they used a nipple shield ($p < .05$), test-weighing ($p < .001$), or a pacifier ($p < .001$), during the first week at home.

There was no difference in infants' feeding behaviour during the first week at home between LPT groups ($p > .05$), or at 1 month ($p > .05$; Table 3). Significantly more mothers of LPT infants indicated that their infant had problems related to the feeding behaviour during the first week at home and at 1 month, compared with mothers of term infants. At 1 month, the duration of feeding sessions was longer ($p < .05$) and less frequent ($p < .01$) in LPT infants compared with term infants.

There were no statistically significant differences between any of the groups with regard to breastfeeding problems in the first week, $p > .05$, nor were there any statistically significant differences between the three groups regarding how easy the mothers found feeding to be at 1 month (Table 3).

3.4 | Predictors for breastfeeding exclusivity at 1 month in late preterm infants

In the unadjusted and adjusted regression analyses, the two groups of LPT infants were merged into one group (Table 4).

In the adjusted regression analyses, findings showed that being a single mother, using a nipple shield, not having been fed breast milk exclusively during the first week at home, and feeding less than 10 times per day at 1 month of infants' age increased the odds for not breastfeeding exclusively at the breast. When adjustments were made for maternal education and gestational weeks at birth, using a nipple shield, not having been fed breast milk exclusively during the first week at home and feeding less than 10 times per day at 1 month of infant's age increased the odds for not breastfeeding exclusively at breast at 1 month. Having an abundance of breast milk during the first week at home constituted a protective factor for exclusive breastfeeding at breast.

TABLE 1 Characteristics of the participating mothers and LPT infants from NICU (n = 60), LPT infants from MU (n = 62), and term infants (n = 269)

	LPT NICU (a)		LPT MU (b)		Term (c)		p-value		
	n	%	n	%	n	%	a/b	b/c	a/c
Hospital stay									
<1 day	0	0	5	8	151	56	*	***	***
1–6 days	29	48	47	76	116	43	**	***	ns
7–13 days	24	40	8	13	2	1	***	***	***
14–28 days	6	10	2	3	0	0	ns	**	***
>29 days	1	2	0	0	0	0	ns	ns	ns
Mother									
Vaginal birth	32	53	45	73	205	76	*	ns	***
Married/living with partner	51	85	54	87	248	92	ns	ns	*
Maternal age, mean (SD)	29.1 (6.6)		30.5 (5.9)		30.0 (5.7)		ns	ns	ns
Household income/month (ISK)							*	ns	**
<400.000	19	32	12	19	53	20			
400–800.000	35	58	31	50	121	45			
>800.000	6	10	17	27	89	33			
Highest educational level							ns	ns	ns
University	31	52	35	56	179	67			
High school	18	30	17	27	56	21			
Elementary	10	17	7	11	23	9			
Illness last year									
Diabetes	8	13	3	5	2	1	ns	*	***
Depression	10	17	15	24	43	16	ns	ns	ns
Anxiety	21	35	21	34	71	26	ns	ns	ns
Multipara	22	37	23	37	151	56	ns	*	*
Have breastfed before	19	86	22	96	150	99	ns	**	**
Infant									
Gestational age at birth in weeks							***		
34 + 0–34 + 6	26	43	0	0					
35 + 0–35 + 6	19	32	19	31					
36 + 0–36 + 6	15	25	43	85					
Birth weight, grams, mean (SD)	2570 (566)		2821 (460)		3730 (469)		**	***	***
Apgar 5 min, median (IQR)	9 (8–9)		10 (9–10)		10 (9–10)		**	ns	**
Girl	23	38	35	56	137	51	*	ns	ns
Weight at 1 month, grams, mean (SD)	3717 (763)		3871 (747)		4627 (704)		ns	***	***

Note. a = LPT from NICU, b = LPT from Maternity Unit, c = Term infants. a/b, b/c, and a/c = Difference between groups. 1.0 ISK = 0.01EUR.

Abbreviations: IQR, interquartile ratio; ISK, Icelandic króna; LPT, late preterm; NICU, neonatal intensive care unit; MU, maternity unit; SD, standard deviation.

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

4 | DISCUSSION

This study adds important, detailed clinical data to the available evidence on breastfeeding in LPT infants who were admitted to a NICU, LPT infants from the maternity unit, and term infants. Our major findings were that the initiation of breastfeeding and breast milk expression was very different between the two LPT groups; mothers of LPT NICU infants initiated breast milk expression much earlier than mothers of LPT MU infants, whereas the latter initiated breastfeeding at the breast earlier. Furthermore, LPT infants were less likely to be fed breast milk and to be exclusively breastfed at the breast at 1 week and 1 month compared with term infants. However, the three groups

TABLE 2 Breastfeeding progression in the participating mothers and LPT infants from NICU (n = 60), LPT infants from MU (n = 62), and term infants at 1 week and 1 month at home (n = 269)

	LPT from NICU (a)				LPT from Maternity ward (b)				Term (c)				p-value			p-value		
	1st week		1 month		1st week		1 month		1st week		1 month		1st week			1 month		
	n	%	n	%	n	%	n	%	n	%	n	%	a/b	b/c	a/c	a/b	b/c	a/c
Time of first breastfeeding													***	ns	***			
<6 h	20	33			57	92			258	96								
6–24 h	15	25			4	7			6	2								
>24 h	19	32			1	2			2	1								
Not breastfed at hospital	6	10			0	0			3	1								
Breast milk													ns	***	***	ns	**	***
Exclusive	38	63	35	58	35	56	33	53	231	86	206	77						
Partial	17	28	14	23	24	39	21	34	31	12	51	19						
No	5	8	11	18	2	3	6	10	5	2	10	4						
Methods for feeding (several methods optional)																		
Breast	51	85	48	80	59	95	54	87	263	87	255	95	*	ns	***	ns	ns	***
Bottle	37	62	29	48	31	50	29	47	38	14	69	26	ns	***	***	ns	**	**
Finger feeding	6	10	0	0	22	35	1	2	22	8	2	1	**	***	ns	ns	ns	ns
Cup feeding	3	5	0	0	9	15	0	0	24	9	2	1	ns	ns	ns	ns	ns	ns
Supplemental nursing system	2	3	0	0	4	6	0	0	5	2	1	0.4	ns	*	ns	ns	ns	ns
Feeding tube	8	13	0	0	1	2	0	0	0	0	0	0	*	ns	ns	ns	ns	ns

Note. a = LPT from NICU, b = LPT from Maternity Unit, c = Term infants. a/b, b/c, and a/c = difference between groups.

Abbreviations: LPT, late preterm; NICU, neonatal intensive care unit; ns, not significant; MU, maternity unit.

*p ≤ 0.05. **p ≤ 0.01. ***p ≤ 0.001.
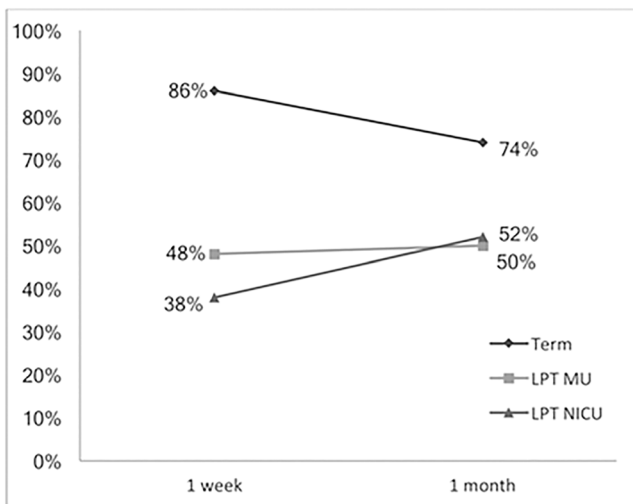
FIGURE 1 Proportion of exclusive breastfeeding at the breast in mothers of term (n = 269), late preterm infants from the maternity unit (LPT MU, n = 62), and late preterm infants from the neonatal intensive care unit (LPT NICU, n = 60)

showed different trends in exclusive breastfeeding progression between 1 week and 1 month; a decline was seen in mothers of term infants, a stable trend in mothers of LPT MU infants, and an increase in exclusive breastfeeding at breast among mothers of LPT NICU infants, although not statistically significant. Variables that increased the risk for not being exclusively breastfed at breast in LPT infants at 1 month were usage of a nipple shield, not being fed breast milk exclusively during the first week home, and being fed less than 10 times per day at 1 month of infants' age. A protective factor for exclusive breastfeeding at breast at 1 month was the mothers' experience of having an abundance of milk during the first week at home. These findings will be discussed in turn.

Our result showed that 42% of the LPT NICU mothers expressed breast milk within the first 6 h after delivery compared with 19% of the mothers of LPT MU infants. On the other hand, 33% of the LPT NICU mothers initiated breastfeeding within 6 h compared with 92% of the LPT MU mothers. These discrepancies can not only be explained by infant illness or lower gestational age among the LPT NICU infants but may also be attributed to different strategies and unit policies (e.g., separation of mother and infant, kangaroo care, parental involvement, breastfeeding within an hour, and use of a breast pump), which has recently been highlighted as important for breast milk feeding in moderate preterm infants (Mitha et al., 2019). In the Icelandic NICU, there was a strong emphasis on early expression and milk production and in the maternity unit an emphasis on methods to assure at breastfeeds (i.e., breast, finger feeding, and supplemental system). Evidence supports early milk expression after birth

TABLE 3 Differences between LPT NICU infants (n = 60), LPT MU infants (n = 62), term infants (n = 269) in breastfeeding interventions, behaviour, and difficulties

	LPT from NICU (a)				LPT from MU (b)				Term (c)				p-value 1st week			p-value 1 month		
	1st week		1 month		1st week		1 month		1st week		1 month		a/b	b/c	a/c	a/b	b/c	a/c
	n	%	n	%	n	%	n	%	n	%	n	%						
Interventions																		
Time of first pumping session																		
<6 h	25	42			12	19			1	0.4			**	***	***			
6–24 h	26	43			33	53			18	7			ns	***	***			
>24 h	3	5			7	11			9	3			ns	**	ns			
Did not pump at the hospital	6	10			10	16			241	90			ns	***	***			
Test weighing	35	58	4	7	27	44	5	8	23	9	4	1	ns	***	***	ns	**	*
Used a nipple shield	26	43	14	23	19	31	10	16	45	17	26	10	ns	*	***	ns	ns	**
Pacifier use	48	80	53	88	20	32	54	87	140	52	219	81	***	***	***	ns	ns	ns
Feeding behaviour																		
Weak suck																		
Never	35	58	51	85	37	60	51	82	243	91	249	93	ns	***	***	ns	*	ns
Sometimes	15	25	7	12	11	18	6	10	16	6	14	5						
Often/Always	10	17	1	2	12	19	3	5	7	3	2	1						
Little stamina and needed encouragement																		
Never	15	25	40	67	17	27	40	65	177	66	196	73	ns	***	***	ns	ns	ns
Sometimes	19	32	18	30	23	37	17	27	60	22	64	24						
Often/Always	26	43	2	3	20	32	3	5	29	11	7	3						
Did not wake up often enough to feed																		
Never	19	32	44	73	15	24	52	84	193	72	239	89	ns	***	***	ns	ns	**
Sometimes	20	33	14	23	22	35	7	11	52	19	24	9						
Often/always	21	35	2	3	23	37	1	2	21	8	2	1						
Duration of feeding																		
<30 min			31	52			30	50			183	68	ns	***	***	ns	**	*
30–45 min			23	38			22	37			72	27						
>45 min			5	8			8	13			10	4						

(Continues)

TABLE 3 (Continued)

| | LPT from NICU (a) | | | | LPT from MU (b) | | | | Term (c) | | | | p-value 1st week | | | p-value 1 month | | |
| | 1st week | | 1 month | | 1st week | | 1 month | | 1st week | | 1 month | | a/b | b/c | a/c | a/b | b/c | a/c |
	n	%	n	%	n	%	n	%	n	%	n	%						
Number of feedings per 24 h																ns	ns	**
≤9 times			52	87			45	76			181	67						
≥10 times			7	12			14	24			86	32						
Feeding difficulties																		
Not enough milk	11	18	18	30	15	24	19	31	61	23	69	26	ns	ns	ns	ns	ns	ns
Abundance of milk	25	42	11	18	23	37	11	18	112	42	67	25	ns	ns	ns	ns	ns	ns
Mastitis	13	22	2	3	16	26	5	8	77	29	21	8	ns	ns	ns	ns	ns	ns
Milk leaking from breasts	29	48	16	27	25	40	18	29	131	49	100	37	ns	ns	ns	ns	ns	ns
Late let down reflex	6	10	3	5	2	3	1	2	11	4	7	3	ns	ns	ns	ns	ns	ns
Cracked/sour nipples	0	0	0	0	2	3	4	6	8	3	5	2	ns	ns	ns	ns	ns	ns
How easy or difficult do you find feeding your infant																ns	ns	ns
Very easy			35	58			34	57			172	64						
Rather easy to difficult			25	42			26	43			95	35						

Note. a = LPT from NICU, b = LPT from Maternity Unit, c = Term infants. a/b; b/c; a/c = Difference between groups;

Abbreviations: LPT, late preterm; NICU, neonatal intensive care unit; ns, not significant; MU, maternity unit.

*p ≤ .05. **p ≤ .01. ***p ≤ .001.

TABLE 4 Odds ratios (ORs) in bivariate and multivariate adjusted logistic regression analysis for not breastfeeding exclusively at breast at infants' postnatal age of 1 month in mothers of late preterm infants (n = 122)

Not exclusively breastfeeding at breast			Unadjusted		Adjusted[a]		Adjusted[b]	
	n	%	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
NICU								
Yes	29	48	1.0	(0.49–2.05)				
No	29	48	1					
Mother								
Birth								
Caesarean	23	58	1.67	(0.77–3.62)				
Vaginal	34	45	1					
Partner								
No/single	11	79	4.53*	(1.19–17.17)	6.63***	(2.51–17.48)	3.78	(0.62–22.94)
Yes	47	45	1					
Maternal age								
<24 years	16	64	2.67	(0.85–8.37)				
25–29 years	14	41	1.05	(0.37–3.01)				
30–34 years	18	50	1.50	(0.53–4.21)				
>35 years	10	40	1					
Income								
<400.000	15	48	1.46	(0.48–4.36)				
400–800.000	34	52	1.65	(0.63–4.35)				
>800.000	9	39	1					
Education								
Elementary	12	71	2.55	(0.81–8.05)				
High School	13	37	1.59	(0.69–3.68)				
University	32	48	1					
Diabetes								
Yes	7	64	1.99	(0.55–7.19)				
No	51	47	1					
Depression								
Yes	14	56	1.48	(0.61–3.58)				
No	44	46	1					
Anxiety								
Yes	23	55	1.49	(0.70–3.16)				
No	35	45	1					
Breastfed before								
No	39	50	1.28	(0.60–2.73)				
Yes	18	44	1					
Infant								
GA weeks								
34	9	35	0.48	(0.18–1.25)				
35	19	51	0.95	(0.42–2.18)				
36	30	53	1					

(Continues)

TABLE 4 (Continued)

Not exclusively breastfeeding at breast			Unadjusted		Adjusted[a]		Adjusted[b]	
	n	%	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Gender								
Boy	28	44	1.48	(0.72–3.05)				
Girl	30	54	1					
Infant first time at breast								
>24 h	10	50	1.14	(0.43–3.07)				
6–24 h	7	37	0.67	(0.24–1.88)				
<6 h	35	47	1					
Exclusive breast milk feeding in 1 week								
No	36	78	8.91***	(3.75–21.16)	16.06***	(7.7–33.52)	7.82**	(2.40–25.50)
Yes	21	29	1		1		1	
Supplemental nursing system								
Yes	4	67	2.22	(0.39–12.62)				
No	44	48	1					
Finger feeding								
Yes	14	50	1.09	(0.47–2.54)				
No	44	48	1					
Cup								
Yes	6	60	1.08	(0.33–3.55)				
No	52	48	1					
Interventions								
Time of first pumping session								
>24 h	2	20	0.21	(0.04–1.14)				
6–24 h	27	47	0.76	(0.33–1.75)				
<6 h	20	54	1					
Test weighing								
Yes	31	51	1.22	(0.60–2.51)				
No	27	46	1					
Nipple shield								
Yes	27	60	2.13*	(1.00–4.52)	2.71**	(1.41–5.22)	3.16*	(1.01–9.89)
No	31	41	1		1		1	
Feeding behaviour 1 week								
Weak suck								
Often/always	16	76	5.66**	(1.86–17.24)	3.42*	(1.01–11.63)	1.54	(0.31–7.76)
Sometimes	15	58	2.41	(0.97–6.02)	1.11	(0.46–2.68)	0.53	(0.14–2.01)
Never	26	36	1		1		1	
Little stamina								
Often/always	23	51	1.19	(0.48–2.94)				
Sometimes	19	45	0.94	(0.37–2.36)				
Never	15	47	1					
Did not wake up often enough to feed								
Often/always	20	46	1.46	(0.59–3.60)				
Sometimes	18	43	1.69	(0.68–4.20)				
Never	19	56	1					

TABLE 4 (Continued)

Not exclusively breastfeeding at breast			Unadjusted		Adjusted[a]		Adjusted[b]	
	n	%	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Feeding rhythm 1 month								
Infant feeds less than 10 times	53	55	5.12**	1.60–16.33	2.36*	(1.15–4.86)	4.59*	(1.01–20.76)
Infant feeds 10 times or more	4	19	1					
Feeding difficulties 1 week								
Insufficient milk supply								
Yes	16	64	2.24	(0.90–5.58)				
No	42	44	1					
Abundance of breast milk								
Yes	12	25	0.19***	(0.08–0.42)	0.39**	(0.21–0.73)	0.15**	(0.05–0.48)
No	46	64	1					
Mastitis								
Yes	13	45	1.20	0.52–2.79				
No	45	49	1					
Late let down reflex								
Yes	5	63	1.86	(0.42–8.14)				
No	53	47	1					
How did you find it feeding your infant								
Rather easy to difficult	27	53	1.38	0.67–2.85				
Very easy	31	45	1					

Note. [a] = adjusted for all presented variables. Cox & Snell *R* squared = .36; Negelkerke *R* squared = .51. [b] = adjusted for all presented variables, mothers education, and infants gestational age. Cox & Snell *R* squared = .42; Negelkerke *R* squared = .56.

Abbreviations: CI, confidence interval; GA, gestational age; NICU, neonatal intensive care unit; OR, odds ratio.

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

in LPT mothers, that is, within 6–12 h post-partum, and to continue with a frequency of 6–11 times a day until breastfeeding is established (Meier, Patel, Wright, & Engstrom, 2013; Parker, Mueller, Sandra, & Krueger, 2017). The early breast milk expression and the emphasis on milk production may also be reasons why more LPT NICU infants received exclusive breast milk during the first week at home compared with LPT MU infants, although the difference was not significant (63% vs. 56%). Thus, a clinical implication of these findings would be that LPT infants, whether they are admitted to the NICU or the MU, would benefit from more support with regard to both early breast milk expression and an early initiation of breastfeeding.

Exclusive breastfeeding at the breast was chosen as the outcome variable in this study. The rationales for this choice were based on the fact that breastfeeding at the breast is the norm in Iceland, where national data show a 98% initiation rate of term infants (Directorate of Health, 2012). The other reason was that previous studies have shown that mothers that exclusively express breast milk do so for a shorter time compared with mothers that exclusively feed their infant at the breast (Forster et al., 2015; Pang et al., 2017; Pinchevski-Kadir et al., 2017). It has also been reported that mothers that combine breastfeeding at the breast and formula feeding have a shorter breastfeeding duration than mothers that exclusively breastfeed at the breast (Holmes, Auinger, & Howard, 2011). Our findings showed that 43% of LPT infants were exclusively breastfed at the breast during the first week at home, compared with 86% of term infants, and at 1 month, the figures were 51% versus 74%. Although these rates for exclusive breastfeeding at the breast are high from an international perspective, and a common finding in comparisons between LPT and term infants (Demirci et al., 2013; Hackman et al., 2016), the difference between term and LPT infants is striking. It is well known that gestational age affects feeding progression in preterm infants (Dodrill, Donovan, Cleghorn, McMahon, & Davies, 2008; Maastrup et al., 2014). At 34 weeks of gestation, the LPT brain only weighs 65% of the brain of a term infant, and during the six remaining weeks of pregnancy, both the grey and white matter of the brain increases four to five times (Hallowell & Spatz, 2012; Kinney, 2006; Lau, Smith, & Schanler, 2003). This increased neurodevelopment consequently improves the oral motor skills and sleep–wake states, contributing significantly to the feeding behaviour of the LPT infant from birth to term, which may possibly explain the difference in exclusive breastfeeding rates between the LPT infants and term infants up until the first week at home.

Our findings on the differences in exclusive breastfeeding at breast from 1 week to 1 month of infants' age are interesting; term infants showed a decrease by 12%; the LPT NICU infants showed a reverse pattern with an increase by 14%, and for the LPT MU infants, the exclusive breastfeeding at the breast rate remained similar. Previous research findings regarding trends are inconsistent; Kair and Colaizy (2016) showed that the odds for breastfeeding for 10 or more weeks were no different between LPT infants from the NICU or MU. However, Hannan, Juhl, and Hwang (2018) showed that mothers of LPT infants from the NICU were less likely to continue to breastfeed for 10 weeks compared with mothers of non-NICU LPT infants. We suggest that these differences may be explained by different attitudes towards LPT infants at the NICU and MU. It might be that mothers of LPT infants in the NICU receive less attention than more preterm and fragile infants. This has been suggested in previous studies (Bonnet et al., 2018; Jang et al., 2012), where findings suggest that mothers with infants of lower gestational age receive more support and attention from hospital staff because of their child's high-risk health status compared with infants with higher gestational age. Furthermore, LPT infants at a maternity unit may be regarded as "term" and not acknowledged as a vulnerable group and hence not supported appropriately (Dosani et al., 2016; Premji et al., 2018; Radtke Demirci et al., 2015). Our study suggests that further efforts are needed to explain why these differences exist, as our results did not show a difference in infants' feeding behaviours or maternal feeding difficulties according to the place of admission and highlight the need for universal LPT breastfeeding guidelines/protocols regardless of the place of admission. Can the differences in trends we found also be explained by the organisation of care after discharge from hospital? Qualitative studies have reported that LPT MU mothers experience a lack of support at home and care aimed at term infants (Dosani et al., 2016; Premji et al., 2018; Radtke Demirci et al., 2015). Potentially, the care during the hospital stay may have a long-term impact, and a NICU stay is protective in the long term.

Factors that were statistically significantly associated to not being exclusively breastfed at the breast at 1 month in LPT infants were being a single mother, usage of a nipple shield, not being fed breast milk exclusively during the first week at home, and being fed less than 10 times per day at 1 month of infants' age. An abundance of milk during the first week at home was a protective factor. Being a single mother and thus needing to cope with becoming a parent and breastfeeding, on your own, is more difficult than when having someone by your side, and numerous studies have shown the negative impact on breastfeeding and an increased risk for children's development if the mother is a single parent (Clarke-Stewart, Vandell, McCartney, Owen, & Booth, 2000). Thus, improved social services for single mothers are needed. Our finding on nipple shields is in line with the results of a literature review by McKechnie and Eglash (2010) that concludes that current published research does not provide evidence for the safety or effectiveness of contemporary nipple shield use for either preterm or non-preterm infants. Feeding less than 10 times per day showed an increased odds ratio by 4.5 for not breastfeeding exclusively. This shows that we need to support

mothers to breastfeed more often, in accordance with a more cue-based style of feeding (Lubbe, 2018). In qualitative studies exploring the mother's experiences of feeding their late preterm infants at home during the first weeks of life, mothers describe their exhaustion due to their efforts to adhere to imposed feeding schedules and conflicting advice from health care staff (Cescutti-Butler, Hemingway, & Hewitt-Taylor, 2019; Dosani et al., 2016; Radtke Demirci et al., 2015). Insufficient milk supply is one of the most common reasons women give for breastfeeding cessation, and this applies to mothers of preterm (Alves, Magano, Amorim, Nogueira, & Silva, 2016; Boucher, Brazal, Graham-Certosini, Carnaghan-Sherrard, & Feeley, 2011; Gianni et al., 2018), late preterm (Kair & Colaizy, 2016), and term infants (Gatti, 2008). The results of the present study suggest that a perception of having an abundance of breast milk, which is the opposite of having a perceived insufficient milk supply, during the first week at home, is a facilitator for exclusive LPT breastfeeding at 1 month. McCarter-Spaulding and Kearney (2001) have pointed out that there is a correlation between perceived sufficient milk supply and breastfeeding self-efficacy. Possibly, if the LPT mother is confident in her milk supply from the start, even though her infant's breastfeeding behaviour is immature, she has more confidence about achieving exclusive breastfeeding.

4.1 | Limitations

One limitation of this study is that the research design and the breastfeeding measures relied on the mother's self-reports, which were collected retrospectively and prospectively. Retrospective breastfeeding self-report data is argued to be subjected to social desirability and recall bias (Burnham et al., 2014). However, studies have found good validity of maternal recall of breastfeeding duration (Amissah, Kancherla, Ko, & Li, 2017). The mothers in our study retrospectively assessed breastfeeding 4 weeks back in time; therefore, it is less likely that the accuracy is biased. Another limitation of this study is that we did not collect data on skin-to-skin contact, mothers' support, or breastfeeding motivation. These are variables and experiences that could have shed light on underlying mechanisms. The study sample was from a university hospital in a Nordic country where breastfeeding is the norm and where the majority of mothers are Caucasian, with high educational level and income. Therefore, caution should be exercised when generalising these findings to LPT dyads in more cultural and socio-economic diverse settings.

5 | CONCLUSIONS

The prevalence of exclusive breastfeeding at breast in LPT infants was less than in term infants. The initiation of breast milk expression and breastfeeding and the breastfeeding progression of LPT infants during the first 4 weeks at home showed different trajectories depending on the place of admission after delivery. This highlights the need for

further research on the feeding progression of LPT infants during the first weeks to guide interventions aimed at optimising breastfeeding rates in this population.

Mothers of late preterm infants should be supported in a way that they are not in a need for a nipple shields after discharge from hospital, as that may result in less exclusive breastfeeding. Expressing breast milk early, alongside early and frequent breastfeeding, might be a good strategy for mothers of LPT infants aiming to exclusively breastfeed their infants at the breast. Potentially, cue-based feeding could be a way forward to support LPT mothers and their infants in becoming exclusively breastfeeding dyads.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

RJ and AS designed the study; analyses were performed by RJ and RF, and all authors reviewed and revised the manuscript and approved the final manuscript as submitted.

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