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ORIGINAL ARTICLE

# Prospective longitudinal comparative study showed that breastfeeding outcomes were comparable in preterm twins and singleton infants

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## Abstract

**Aim:** We compared milk volumes, skin-to-skin contact and breastfeeding by the mothers of very preterm twins and singleton infants born at 28–32 weeks of gestation.

**Methods:** This Norwegian longitudinal prospective comparative study was carried out in two neonatal intensive care units: one with single family rooms and one open bay unit. It comprised 49 singleton infants, 28 twins and their mothers. The mothers' milk volume and direct breastfeeding were recorded from birth until 4 months' of corrected age. They also answered the breastfeeding self-efficacy scale and skin-to-skin contact was recorded.

**Results:** The mothers of preterm twins produced doubled the volume of expressed milk at day 14, compared to the mothers of singletons (mean 816 ± 430 mL vs. 482 ± 372 mL, $p < 0.05$) and this difference was still sustained at 34 + 0 weeks/days ($p < 0.02$). Mothers of twins had their first breastfeeding attempt later than mothers of singletons (median of 133 h compared to 56 ($p < 0.002$). Preterm twins received less daily skin-to-skin contact (mean 157 ± 66 min each vs. 244 ± 109) ($p < 0.001$). There were no differences in receiving mother's own milk, exclusively direct breastfeeding or perceived breastfeeding self-efficacy.

**Conclusion:** Breastfeeding was initiated as successfully in preterm twins as singletons as the mothers' milk production doubled.

KEYWORDS
breast milk, breastfeeding, neonatal intensive care, preterm, twins

## 1 | INTRODUCTION

Approximately 27% of preterm infants are twins.[1] Twin pregnancies pose an increased risk for both mothers and their infants[2] and these can have consequences for the initiation and success of breastfeeding. Despite the benefits of breast milk for preterm infants,[3] studies have reported wide variations in the rates of initiation and duration of breast milk feeding.[4–6] Some studies have reported that preterm infants are breast fed for a shorter time than term infants.[7–9] The facilities available in a neonatal intensive

**Abbreviations:** NICU, neonatal intensive care unit; PMA, postmenstrual age; SSC, skin-to-skin contact.

care unit (NICU) play a significant role in enabling mothers to be present throughout their infants' hospital stays.[6,10] Preterm infants' ability to breastfeed is a maturational process that starts at birth.[10] Ideally, the infant receives colostrum immediately and then enteral feeding according its tolerance. The infant then receives their mothers' own milk and/or donor milk by tube and gradually increases practising direct breastfeeding or bottle-feeding with their mother's own milk and donor milk and/or formula. Skin-to-skin contact (SSC) play an important role on initiating and facilitating direct breastfeeding.[11] Adequate and competent support from nurses is also important.[12]

Following a preterm birth, the mother's ability to produce milk may be hindered by limited milk-producing tissue[13] and lack of stimulation by the infant. Early pumping or hand expressing within the first 6 h of giving birth can help to establish breastfeeding in preterm infants.[14] However, it has been reported that expressing milk for weeks can be both physically and emotionally challenging for mothers.[15] Breastfeeding a preterm infant can involve complex physical and emotional factors and it is logical to expect that breastfeeding twins are more challenging than singletons.

There are few studies on how hospitalised mothers initiate breastfeeding with twins and how long they continue for. A large percentage of twins are born preterm: 7%, 13% and 41%, before 32, 34 and 37 weeks, respectively.[16] Breastfeeding rates at term are lower in twins than singletons.[17] It has been suggested that about half of all mothers who give birth to term twins experience breastfeeding difficulties, such as failing to achieve sufficient milk supply or immature breastfeeding behaviour in the infant.[18] Multiple births negatively affect breastfeeding progression in preterm infants.[14,19] Similar factors have been associated with the cessation of breastfeeding in preterm twins: insufficient milk production, stress and difficulties related to managing twins.[20,21]

The aim of this study was to compare SSC practices, mothers' milk volumes, breastfeeding initiation and duration, exclusive direct breastfeeding and breastfeeding self-efficacy in mothers of very preterm twins and singletons.

**Key Notes**

- We compared milk volumes and breastfeeding by the mothers of very preterm twins and singletons born at 28–32 weeks of gestation.
- The mothers of preterm twins produced doubled the volume of expressed milk at day 14, compared to the mothers of singletons, and this difference was still sustained at 34 + 0 weeks/days.
- From the postmenstrual age of 34 weeks, preterm twins were breastfed to same extent as preterm singleton infants.

## 2 | PATIENTS AND METHODS

### 2.1 | Design and setting

This prospective, longitudinal cohort study was conducted in Norway, where hospital care is financed through public health insurance and is free of charge for all citizens. No private neonatal intensive care is available. Parents have extensive publicly financed social security benefits during pregnancy and when giving birth. Both parents are generally entitled to take time off with full pay if their infant is in hospital. We have previously documented the how often parents are present during hospitalisation.[22]

Two different NICU units in maternity hospitals in Norway participated in this study: one unit with single family rooms near the capital, Oslo, and an open bay unit on the western Norwegian coast. Both units provided care from birth until discharge for all infants born from 28 weeks of gestation within their hospital referral area. The parents had unlimited access to their infant at all hours, but they could only stay overnight in the single family room unit. SSC was an established practice at both units and was encouraged whenever parents were present. The two units had agreed on a common feeding protocol, which has previously been published.[23] Both units had access to donor breast milk and had dedicated breastfeeding consultants. The single family room unit had five fully-trained lactation support providers and the open bay unit had six. Staff in both units encouraged and guided mothers to provide mothers' own milk from day 1. They were advised to express by hand six to eight times per day in the first few days after birth and then double pump using an electric breast pump at least eight times per day, including once during the night. The same brand of electric breast pump, Medela (6340 Baar, Switzerland), was used in both NICUs. During the time of the study there were no early discharge programmes or homecare in either of the units.

The study protocol was approved by the Norwegian Regional Committee for Medical Research Ethics and registered in ClinicalTrials.gov (NCT 02452580).

### 2.2 | Participants

The parents were consecutively recruited by two of the authors (BST and HG) when their infants were admitted to the NICUs from 1 May 2014 to the 31 July 2016. The parents received the same verbal and written information and were included if both of them gave written consent by the second day of life. The parents of very preterm infants born at a gestational age of 28 + 0 to 32 + 0 weeks/days were included. Gestational age was based on ultrasound assessments at 17–18 weeks of pregnancy or the last menstrual period if an ultrasound assessment was not performed. We excluded infants with congenital malformations, as well as infants who experienced major complications, such as intraventricular haemorrhage grade III/ IV or necrotising enterocolitis. Infants with a birth weight of <800 g were also excluded. Infants were excluded if their parents had a major mental illness or who did not understand Norwegian language or the

mothers had used illicit drugs or were on drug-assisted rehabilitation during pregnancy. We also excluded infants who were in the custody of Child Protection Services from birth.

## 2.3 | Data collection

Demographic variables and data on vital measures and data on morbidity were collected on the infants during hospitalisation. In addition we collected data on the age and education of both parents. Both parents recorded the time they spent in SSC on their bare chest daily in a diary from birth until their infants was a postmenstrual age of 34 weeks. Twins had separate diaries.

Mothers reported the first time they expressed milk postpartum. They also reported the total volume of milk expressed, and or directly breastfed during a 24-h period, at days seven and 14 of life, and at a postmenstrual age of 34 + 0 weeks days/weeks. Directly breastfed volumes were measured using a weight test and 1 g of infant weight gain was considered to be equivalent to 1 mL of milk. Data on exclusive and partial breastfeeding was retrieved from the infants' medical charts at birth and at discharge. They were reported by the mothers at term and 4 months of corrected age using the World Health Organization definition.[24] The distinction was made between breastfeeding directly and providing mothers' own milk by cup, spoon and or bottle. The direct breastfeeding was retrieved from the infants' medical chart during hospitalisation and was reported by the mothers at term and 4 months of corrected age. This was categorised as exclusively direct breastfed, partly direct breastfed and the third category, not breastfed.

Breastfeeding self-efficacy commonly refers to a mother's perceived expectation of their own capacity to cope with breastfeeding. In this study it was measured using the breastfeeding self-efficacy scale, short form.[25] This instrument consists of 14 Likert scale items and can be used to identify breastfeeding mothers who risk stopping breastfeeding early. The total score can range from (14–70), with higher scores indicating higher self-efficacy. The Scale has also been found to be reliable and valid for the mothers of preterm and sick infants.[26] Mothers who exclusively or partly breastfed at discharge answered the Norwegian version[27] of the Scale. After discharge, all infants had scheduled follow-up visits at term and at 4 months of corrected age.

## 2.4 | Data analysis

The main exposure was being a twin and the outcomes were demographic variables. These were the mother's milk volumes, the extent to which infants received their mother's milk, the rate of direct breastfeeding and the self-efficacy scale score. Descriptive statistics are given as means with standard deviations (SD), medians with quartiles (q1–q3) or frequencies (%) according to the type and distribution of data. Bivariate analyses, two-sample *t*-tests and Pearson's chi-square tests were used to compare groups. The data were analysed using SPSS version 28 (IBM Inc). A $p$ value <0.05 was considered statistically significant.

# 3 | RESULTS

There were 120 very preterm neonates admitted during the study period: 51 to the single family room unit and 69 to the open bay unit. Of these, 33 were not eligible, 8 parents did not want to take part and 2 withdrew. This left 77 neonates born to 132 parents in the study. They included 28 twins, 10 in the single family room unit and 18 in the open bay unit. The twins were compared to 49 singleton infants: 25 in the single family room unit and 24 in the open bay unit. All infants were cared for by their respective NICU from birth until discharge and morbidity was low in both the twins and singletons. In addition, the parents were comparable, with no significant differences in demographic variables (Table 1).

The twins received significantly less SSC, with a mean of 157 ± 66 min each from their mother, compared to 244 ± 109 for the singletons ($p < 0.001$). There was no significant difference between the SCC that the fathers provided twins and singletons during hospitalisation (Table 2).

By day 14, mothers of twins had nearly twice as much of expressed milk compared to the mothers of singletons; a mean of 816 ± 430 mL compared to 482 ± 372 mL ($p < 0.05$).

The difference in volumes was sustained by 34 + 0 weeks/days of gestation, with 792 ± 394 mL and 510 ± 327 mL, respectively ($p < 0.02$) (Table 3). Mothers of preterm twins preformed the first breastfeeding attempt significantly later than in singletons. Their first attempt occurred at a median of 133 h, range 12–312, compared to a median of 56 h, range 3–600, ($p < 0.002$) for mothers of the singletons. In spite of delayed first time attempt, the mothers of preterm twins initiated breastfeeding successfully.

There were no significant differences between twins and singletons when it came receiving their mothers' own milk or exclusive direct breastfeeding. At a postmenstrual age of 34 weeks 92% of the twins received their mother's own milk by any feeding method (tube, breast, cup or bottle), either exclusively (71%) or partly (21%) and 47% of the mothers of twins were able to breastfeed directly in some extent at the mothers' breast. The same percentage were reported regarding mothers of singletons, (92%) received their mother's own milk, either exclusively (73%) or partly (19%) ($p = 0.95$), and 48% of them were able to perform some direct breastfeeding.

When they were discharged at a mean age of 36 + 5 post menstrual age, the percentage of twins still receiving their mothers own milk by any feeding method, were 71% exclusively and 14% partly, and 75% of them did some of the breastfeeding directly from the mothers' breast. The corresponding percentages for the singletons, discharged at a mean age 36 + 0 post menstrual age, were 73% receiving their mothers' own milk by any feeding method exclusively and 13% partly. The percentage of direct breastfeeding in singleton at discharge was 81% ($p = 0.976$). Nor were there differences in receiving mothers' own milk or in direct breastfeeding by breast at term or 4 months of corrected

**TABLE 1** Characteristics of the families and infants.

| Characteristics | Singleton | Twins |
|---|---|---|
| Infants, *N* = 77, (%) | 49 (64%) | 28 (36%) |
| Gender, male number (%) | 24 (49%) | 19 (68%) |
| Gestational age at birth; weeks$^{days}$ Mean (SD) | 30$^{2\ (1)}$ | 30$^{3\ (1)}$ |
| Caesarean section number (%) | 29 (59%) | 16 (57%) |
| Weight at birth; grams mean (SD) | 1416 (316) | 1412 (230) |
| Days to regain birth weight mean (SD) | 9 (3) | 10 (3) |
| PMA at regain birth weight mean (SD) | 221 (8) | 224 (7) |
| Mechanical ventilation; days of treatment mean (SD) | 0.1 (0.4) | 0.4 (0.8) |
| Continuous positive airway pressure; days median (min-max) | 5 (5,8) | 4 (4, 7) |
| Phototherapy; hours of treatment median (min-max) | 20 (18, 33) | 21 (15,39) |
| PMA at discharge, days median (min-max) | 252 (7) | 257 (17) |
| Length of stay; days mean (SD) | 40 (11) | 44 (21) |
| Weight at discharge; grams mean (SD) | 2293 (282) | 2327 (328) |
| Weight at term mean (SD) | 3300 (521) | 3376 (387) |
| Weight at 4 months' corrected age mean (SD) | 6588 (1038) | 6820 (459) |
| Mothers (*N* = 66) Fathers (*N* = 65) | | |
| Age; years mean (SD) mother | 32 (7) | 31 (6) |
| Father | 35 (9) | 34 (8) |
| Education level Number (%) mother | | |
| Elementary | 2 (4%) | 4 (14%) |
| High school | 17 (35%) | 5 (18%) |
| College/University | 29 (60%) | 20 (71%) |
| Father | | |
| Elementary | 2 (4%) | 2 (7%) |
| High school | 23 (49%) | 9 (32%) |
| College/University | 22 (47%) | 17 (61%) |

*Note*: All non-significant. One singleton mother and two singelton fathers missing in the categorisation.

**TABLE 2** Daily registrations of skin-to-skin contact (SSC) from birth to 34 weeks postmenstrual age.

| | Singleton | Twins | *p*-value |
|---|---|---|---|
| First SSC (hours) after birth (any of the parents), hour, **median (min-max)** | 5 (0, 49) | 10 (0, 48) | 0.117 |
| Total hours of SSC by mother during hospitalisation **mean (SD)** | 100 (48) | 65 (30) | 0.002 |
| Total hours of SSC by father during hospitalisation **mean (SD)** | 42 (30) | 37 (17) | 0.46 |
| Minutes of SCC per day by mother **mean (SD)** | 244 (109) | 157 (66) | 0.000 |
| Minutes of SCC per day by father **mean (SD)** | 101 (61) | 88 (32) | 0.31 |

*Note*: Groups were compared by a two-sample t-test and a Mann–Whitney test.
Abbreviation: SSC, skin-to skin contact.

age comparing twins with singletons. The total score on the self-efficacy questionnaire did not differ significantly between mothers of twins and singletons at discharge (Table 4).

## 4 | DISCUSSION

Our findings showed that mothers of very preterm twins had their first breast milk expression by pump later and their first attempt of breastfeeding occurred significantly later compared with singleton. The very preterm twins also received significantly less SSC from their mothers. In spite of this, mothers of preterm twins were able to establish breastfeeding during hospitalisation in the NICU to the same degree as singletons. Mothers of twins expressed more milk and maintained sufficient milk supply, thus fulfilling the requirement for higher volumes. At discharge, a high rate of direct breastfeeding by breast was observed among both singletons and twins. Even though the proportion of mothers who breastfed was lower at 4

**TABLE 3** Pumping, mothers' own milk volume.

| | Singleton | Twins | *p*-value |
|---|---|---|---|
| First time pumping, hours after birth, median (min-max) | 9 (2, 60) | 24 (16, 36) | 0.487 |
| Volume (mL) mothers' own milk, day 7, mean (SD) | 399 (251) | 584 (391) | 0.152 |
| Volume (mL) mothers' own milk, day 14 | 482 (372) | 816 (430) | 0.003 |
| Volume (mL) mothers' own milk, at infant age GA 34 + 0 days | 510 (327) | 792 (394) | 0.002 |

*Note:* Groups were compared by a two-sample t-test and a Mann–Whitney test.

**TABLE 4** Nutrition, practices and breastfeeding categorisation of Mothers Own Milk (MOM) and direct breast feeding from breast from hospitalisation to 4 months' corrected age.

| | Singleton | Twins | *p*-value |
|---|---|---|---|
| First breastfeeding attempt, hours after birth, **median (min-max)** | 56 (3, 600) | 133 (12, 312) | 0.002 |
| **At 34 + 0 PMA** | | | |
| Categorisation of breastfeeding with MOM, **number (*N*) percent (%)*** | | | 0.951 |
| Exclusive | 35 (73%) | 20 (71%) | |
| Partly | 9 (19%) | 6 (21%) | |
| None | 4 (8%) | 2 (7%) | |
| Still feed full or partly by tube, ***N* (%)** | 46 (96%) | 28 (100%) | 0.274 |
| Direct breastfeeding by breast, ***N* (%)** | 23 (48%) | 13 (47%) | 0.900 |
| **At discharge** | | | |
| Categorisation of breastfeeding with MOM, ***N* (%)*** | | | 0.976 |
| Exclusive | 35 (73%) | 20 (71%) | |
| Partly | 6 (13%) | 4 (14%) | |
| None | 7 (15%) | 4 (14%) | |
| Direct breastfeeding by breast, ***N* (%)** | 39 (81%) | 21 (75%) | 0.519 |
| Mothers' score on breastfeeding self-efficacy, **mean (SD)** | 53 (14) | 52 (10) | 0.889 |
| **At Term age** | | | |
| Categorisation of breastfeeding with MOM, ***N* (%)**** | | | 0.373 |
| Exclusive | 25 (56%) | 11 (42%) | |
| Partly | 11 (24%) | 6 (23%) | |
| None | 9 (20%) | 9 (35%) | |
| Direct breastfeeding by breast at term, ***N* (%)** | 33 (73%) | 16 (62%) | 0.971 |
| **At 4 months' corrected age** | | | |
| Categorisation of breastfeeding with MOM, ***N* (%)***** | | | 0.771 |
| Exclusive | 7 (15%) | 2 (8%) | |
| Partly | 17 (37%) | 10 (39%) | |
| None | 22 (48%) | 14 (54%) | |
| Started solid food****** | | | 0.380 |
| Yes | 39 (87%) | 26 (100%) | |
| No | 6 (13%) | 2 (8%) | |
| Direct breastfeeding by breast, ***N* (%)** | 20 (44%) | 12 (46%) | 0.403 |

*Note:* Breastfeeding self-efficacy was measured by the breastfeeding self-efficacy scale–short form (BSES–SF) questionnaire.

Abbreviations: MOM, Mothers Own Milk, PMA, Postmenstrual age.

*One singleton infant missing in the categorisation.; **Four singleton infants and two twin infants missing in the categorisation.; ***Three singleton infants and two twin infants missing in the categorisation.; ****Four singleton infants missing in the categorisation.

Groups were compared by a two-sample *t*-test, Mann–Whitney test (continuous variables) and Pearson's $\chi^2$ and Fisher's tests (categorical variables).

months of corrected age, the rate of exclusive direct breastfeeding in twins was similar to that in singletons.

Delayed pumping and breastfeeding attempts in mothers of preterm twins may be due to several factors related to giving birth to twins. The birth itself with the following postpartum care of the mother and stabilising two infants instead of one, could explain this delay. The focus is on wellbeing of the preterm infants and initiating breastfeeding may be considered secondary. It could also be argued that this will be the obvious finding unless both twins are doing the first attempt at the same time. Otherwise, the second twin will always contribute with later debut to the twin group and at group level, twins will be slower to start even if the first twin started at the same time as singletons did. Unfortunately we cannot provide data with such detailed information. Further, the significantly shorter duration of SSC in preterm twins compared to preterm singletons is worth noting. It is possible that mothers might prefer performing SSC with one infant at the time to be able to sufficiently bond and interact with both of the infants. Therefore, the total time of SSC in twin mothers may be longer even though resulting in less time for each infant. It should also be noted that units may also have differing practices concerning the initiation of pumping and breastfeeding. In the open bay unit there were no possibility to stay overnight, 18 of the 28 participating twins were hospitalised without the possibly. This aspect may explain some parts of the delayed pumping and shorter duration of SSC in the preterm twins. However, the main finding in this study is the positive breastfeeding outcome in preterm twins. This finding may be partly due to socio-cultural aspects. There is a general attitude towards supporting breastfeeding in Nordic societies, and cultural expectations, verbal persuasion and support may enhance maternal efforts to accomplish breastfeeding.[28] Our results are different from those of others who have found lower breastfeeding rates in preterm twins, within the same cultural context.[14] We have previously documented the prevalence of physical presence of both parents and the high degree of SSC in the two units, which may partly explain the positive findings of breastfeeding in twins as well. Is the positive association of SSC and direct breastfeeding influencing the infants' ability to breastfeed or to the mothers' ability to produce mothers own milk, or both? The pathway of potential biological mechanisms between SSC and breastfeeding is not known. The father's presence and supportive attitudes may also be highly important,[6] especially when breastfeeding twin preterm infants.

The overall strength of this study was the longitudinal design and detailed data collection regarding mother's own milk and breastfeeding. To our knowledge this study is the first to report the time of first pumping, mothers milk volume, mothers breastfeeding attempt and direct breastfeeding in very preterm twins compared to preterm singletons. There are very few previous studies conducted on breastfeeding and preterm twins, and therefore we consider the results of this study noteworthy, even though the sample of twins was small. There were also some other limitations to this study. We did not have specific data on mothers of twins assessments of and experiences with the process of initiating and establishing breastfeeding. Mothers' physical and emotional states and how they experience attunement with their infant have been shown to be positive facilitators for breastfeeding preterm infants.[12] In retrospect, it could have been beneficial to have more information on the twin mothers' motivation and expectation regarding breastfeeding over time. There were no differences in breastfeeding self-efficacy at discharge between twin and singleton mothers. The mothers of twins own expectations about coping with breastfeeding were similar, which supports the assumption that mothers of twins are also highly motivated to breastfeed. They achieved scores similar to those of singleton mothers in this study, and, additionally, the scores were congruent with previous results.[29] As high breastfeeding self-efficacy also predicts longer exclusive breastfeeding in mothers of preterm infants, detecting the self-efficacy score may help to target breastfeeding support. The BSES-SF questionnaire and or more expanded information before commencing breastfeeding and or pumping at term and at 4 months, would have been beneficial. Jónsdóttir and colleagues found no differences between late preterm twins and term singletons until 1 month after discharge, but a significant difference by 4 months of postnatal age.[30] In our study, at 4 months of corrected age all of the infants had started solid food, and many were weaned. There may be differences in breastfeeding patterns between discharge and 4 months of corrected age that were missing in this study. The results may not be directly applicable for a population of extreme premature infants as infant morbidity may impact breastfeeding abilities in both mothers and infants. On the other hand, a larger volume of preterm infants are born after 28–30 gestational weeks, and therefore our population is representative of most preterm births.

## 5 | CONCLUSION

Our results showed that mothers of twins were as likely to breastfeed as mothers of singletons. Further, twins were fed as much breast milk as singletons, and thus there were no differences in the exclusivity of reviving mothers own milk and direct breastfeeding. This positive finding may contribute to the information and guidance about breastfeeding given to mothers and fathers of preterm twins.

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### CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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