Barriers to sustained mother's own milk feeding in newborns admitted to the neonatal intensive care unit or special care nursery.

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Abstract

Background Breast milk feeding is the optimal nutrition for all neonates including preterm newborns. Factors influencing mother's own milk (MOM) feeding at discharge need to be acknowledged and addressed appropriately.

Methods Data was collected from electronic patient charts of the University Hospital Carl Gustav Carus, Dresden, Germany. All infants admitted to the neonatal intensive care unit (NICU) or special care nursery in the first two days of life during a period of three years were included. Multivariable logistic regression analysis was used to determine sociodemographic and medical factors associated with MOM feeding at discharge.

Results At discharge, 54.9% of the infants were exclusively MOM fed, 44.4% of infants born ≥ 37 weeks, 56.1% of infants born between 32 and 36+6 weeks and 59% of infants born < 32 weeks gestation. In early preterm infants, first breastfeeding after the first 14 days of life, absent maternal nicotine abuse and vaginal delivery were associated with MOM feeding. For infants born 32 - 37 weeks, MOM feeding was more common with first breastfeeding after the first 14 days of life, lower birth weight and for women without gestational diabetes. For infants born ≥ 37 weeks MOM feeding was associated with first breastfeeding within the first 14 days.

Conclusions A significant number of infants were not fed MOM at discharge. We identified groups that may benefit from targeted interventions to promote MOM feeding.

Background

Breast milk feeding has significant advantages for infants. For full-term infants, it is associated with neurodevelopmental [1] and cardiovascular benefits [2], and with lower rates of obesity [3]. The positive effects of breast milk feeding are even greater in preterm infants: premature infants receiving their mother's own milk (MOM) have a lower incidence of necrotizing enterocolitis [4], sepsis [5] and retinopathy of prematurity than formula fed preterm infants [6]. In addition, MOM reduces the risk of bronchopulmonary dysplasia [7] and metabolic syndrome [8]. Breastfeeding is also advantageous for mothers: It reduces the risk of breast and ovarian cancer [9], postpartum bleeding and promotes uterine involution [10]. Economic and environmental benefits have been described additionally: Health care costs are reduced and parents gain higher family income [11]. The costs for institutions to supply breast milk during hospitalization are relatively low in comparison to other healthcare-related costs [12].

The American Academy of Pediatrics and the World Health Organisation recommend exclusive breastfeeding for the first 6 months [13]. MOM is the first choice of nutrition for all neonates including preterm infants.

Hospitalization after birth, however, raises barriers for an adequate breast milk production. Mother and child are separated, and it is necessary to express breast milk for several weeks before the infant can be breastfed. Further influencing factors have been described previously: delivery via caesarean section [14], late skin-to-skin-contact and delayed kangaroo mother care [15], long length of stay [16], marital status [17], multiples [17], gestational diabetes [18], nicotine abuse [19], low birth weight and gestational age [20].

Paediatricians and NICU staff need to be aware of risk factors that reduce the rate of MOM feeding. Strategies to promote breastfeeding can be targeted at infants and families being at risk for formula feeding during hospitalization and after discharge.

The purpose of this study was to investigate associations between maternal-neonatal factors and MOM feeding for term and preterm infants hospitalized in the nursery or the neonatal intensive care unit of a level III centre in

Germany.

Methods

This retrospective study comprised all newborns discharged between April 1, 2013 and March 31, 2015, from the Department for Neonatology and Paediatric Intensive Care Medicine, Technical University of Dresden, Germany, which is a level III neonatal centre. Included were infants born at the Department for Obstetrics and Gynaecology, Technical University of Dresden, and requiring admission to the nursery or the neonatal intensive care unit or transferred to the nursery or NICU within 48 hours after delivery from a community hospital. Excluded were all infants being re-admitted after discharge. Data were collected from the electronic patient charts (Integrated Care Manager®, Draeger, Luebeck, Germany and ORBIS, Agfa HealthCare, Bonn, Germany).

The primary outcome was the nutrition during the last 48 hours prior to discharge: Infants in the MOM group received their own mother's breast milk exclusively. Neonates which received formula at least once in that time frame were included in the non-MOM group (NMOM). We did not discriminate between breastfeeding or bottle feeding.

It is hospital policy to encourage mothers to use electrical milk pumps which are available in hospital and are prescribed for use at home after the mother is discharged. Extracted breast milk is stored in a central hospital facility and thawed for each use. For preterm infants, breast milk was fortified after reaching full enteral nutrition using Nestle Beba FM85 (Nestle Nutrition GmbH, Frankfurt, Germany) and/or medium chain triglycerides (Ceres oil) and/or protein powder.

Neonatal variables include birth weight (BW), completed weeks of gestation (GA), intubation in the delivery room, skin-to-skin contact in the delivery room, first day of breast feeding (≤ two weeks of life / > two weeks of life), kangarooing, days of nutrition per gastric tube, respiratory support without notice of the duration (none/Continuous Positive Airway Pressure (CPAP) or mechanical ventilation for newborns below 37 weeks and none or CPAP/intubation for newborns ≥ 37 weeks), abdominal surgery, length of stay in hospital (LOS), length of stay on NICU, corrected gestational age at discharge and type of discharge (home or into a different hospital/rehabilitation centre).

Maternal variables included maternal age, professional degree (academic or non-academic), marital status, mode of delivery (vaginal birth or caesarean section), number of previous deliveries, number of antenatal consultations, length of hospital stay before delivery, multiple births, gestational diabetes, nicotine abuse and mode of conception.

Data was collected using Microsoft Excel 2010® (Microsoft Corporation, Redmond, Washington, USA) and statistical analyses were performed with SPSS 23.0 (IBM®, Chicago, IL, USA).

Categorical data is presented as absolute and relative frequency. Continuous data was not normally distributed and presented as median and IQR (25th percentile; 75th percentile). All variables potentially influencing the primary outcome were analysed using the chi-square test or the Mann-Whitney U test. $p < 0.05$ was judged as statistically significant. All analyses were performed separately for infants born < 32, infants born 32—37 and infants ≥ 37 weeks of gestation.

Independent variables identified in the bivariate analysis ($p<0.05$) were included in a multifactorial logistic regression analysis. Results are expressed as odds ratios with 95% confidence intervals for infants receiving MOM exclusively at discharge.

Results

Patient characteristics

623 patients fulfilled all inclusion criteria, with 88% being in- and 12% being out-born. 251 (40.3%) infants were born < 32 weeks, 246 (39.5%) between 32 and 37 weeks and the remaining 126 (20.2%) had a gestational age ≥ 37 weeks (Table 1).

About 20% (n = 124) of the infants were never admitted to the NICU, 37% (n = 228) stayed on NICU for less than one week, 28% (n = 36) stayed between 8—28 days, and the remaining 35% stayed longer than four weeks on the NICU. Regarding the total LOS in hospital, 13% (n = 82) stayed less than a week, 49% (n = 307) between 1 and 4 weeks, and the remaining 38% stayed longer.

Feeding

At discharge, 22% were exclusively on formula, and 55% on exclusive MOM. Out of the 342 infants with exclusive MOM, 12.9% were breastfed, 29.2% bottle-fed and 1.2% were fed via nasogastric tube. MOM feeding was especially common in infants between 28 and 36 weeks of gestation, whereas formula-feeding was more common in very preterm or term infants (Figure 1). First breastfeeding happened in median at day 7 (range 1 - 166). The median gestational age at first breastfeeding was 34+5 weeks corrected (range 29+4 - 47+6).

Only about one third received skin-to-skin contact in the delivery room (n = 179). Out of these infants, 49% were on MOM at discharge. However, out of the 380 infants who did not receive skin to skin contact, 223 (59%) were on MOM at discharge.

First skin to skin contact took place between the first and 52nd day with a median of 4 days. Almost half of the children (291, 46.7%) had their first skin to skin contact within the first three days. Only 13 (2.1%) had their first skin contact with their parents after more than a month.

Factors influencing MOM feeding at discharge

The time of first breast feeding was an important determinant of being on MOM at discharge in all three gestational age groups (Table 2).

Infants from mothers who smoked were less likely to be on MOM at discharge; however, that factor reached statistical significance only in very preterm infants.

More interestingly, infants below 32 weeks of gestation had lower odds to be discharged on MOM if they were born by caesarean section, a factor that was of no relevance in older infants.

Finally, gestational diabetes lowered the odds to go home on MOM, however, only for infants with a gestational age between 32–37 weeks.

Discussion

Our study demonstrates that it is possible to identify infants at risk of not being fed MOM.

The rates of exclusively breast milk fed children in previous studies varies widely in between countries and centres. In our study, it was nearly the same as in the EPICE (Effective Perinatal Intensive Care in Europe) cohort in eleven European countries [21].

We do not discriminate between breastfeeding and feeding extracted MOM because the main beneficial effects of MOM likely apply to extracted MOM as well.

Our study shows that infants born at less than 32 weeks are fed with MOM at the time of discharge more often than children born later. One reason may be the high awareness of the advantages of breastmilk feeding for preterm babies and the support from nurses on the NICU. Contrary, Maastrup et al. showed [22] that extremely preterm and very preterm infants had higher odds of formula feeds at discharge. Unit policies and attitudes towards MOM feeding might differ significantly between hospitals. These differences may explain contrasting findings.

Surprisingly, the smallest share of MOM fed newborns are those with a birthweight above 2000 g. A lack of attention to these preterm infants by NICU staff and feeding protocols could be causal [20]. For infants born 32—37 weeks the regression model of our study shows a significant correlation between the probability of being fed with MOM at the time of discharge and birth weight. One needs to keep in mind that feeding activities might even be more mature at discharge in extreme preterm compared to late preterm infants [23].

Abdominal surgery is a significant factor only for very preterm infants and no longer significant in the regression model. As expected, surgery limits the ability of infants to tolerate feeds and influences the length of stay and affects the expression of breast milk. Also, infants who were not fed MOM are at a higher risk of complications requiring surgery [24].

We expected that a longer hospital stay causes difficulties maintaining breast milk and would lead to a decreased rate of MOM feeding. However, the association between length of stay in hospital for infants under 32 weeks was not significant in the regression model. This contrasts research findings by Kirchner et al. [16] but is confirmed by the study of Zachariassen et al. [25]. Zachariassen showed that infant age at discharge and the duration of hospitalization did not influence breastfeeding at the time of final discharge. Our results indicate that the mother's endurance for long-term pumping can lead to MOM feeding at discharge even if the infant was never breastfed.

The timing of the first skin to skin contact did not show an association in the regression. However, skin to skin contact is described as being positively associated with breastfeeding preterm and term infants [26].

Single women were less likely to feed MOM at the time of discharge which is consistent with other studies [27]. Term born infants without respiratory support had lower odds of MOM feeding than those with respiratory support. This is surprising because we expected that higher morbidity and the need of respiratory support would cause longer duration on NICU and reduce MOM feeding.

Infants born by mothers with gestational diabetes had significantly lower odds of being fed with MOM compared to infants born by mothers without gestational diabetes. This is consistent with other studies [18] and could be caused by delayed lactogenesis and obesity: Overweight women have a lower prolactin response to suckling, their infants have difficulties with latching and body image concerns have been reported to reduce breastfeeding duration [28].

Preterm infants born by caesarean section had significantly lower odds of being fed with MOM as compared with infants born by vaginal delivery. Numerous studies confirm this. Especially primary C-sections pose a risk for breastfeeding [29].

Maternal smoking results in lower odds of being fed with breast milk as compared with infants born by mothers without nicotine abuse for very preterm infants which is consistent with other studies: Smoking mothers breastfeed shorter or do not initiate breastfeeding at all [19]. Mothers perceived the strong risk of harming the baby by smoking and they finished breastfeeding because of the inability to stop smoking [30].

In our study population, the first day of breastfeeding is highly variable, caused by the wide range of gestational age. In addition, a small share of infants receiving extracted MOM was never breastfed. Milk pumping and tube feeding are barriers for the breastfeeding process, even if breastfeeding is possible [31]. Furthermore, we use fortified MOM for preterm babies which causes a higher rate of bottle feeding. For all three study populations, we show a significant correlation between the probability of MOM feeding at discharge and the first time of being breastfed. For infants < 32 weeks, the degree of immaturity complicates the feeding situation. Nyquist et al. [32] initiated breastfeeding from a postmenstrual age of 29 weeks on and reached full breastfeeding at a median of 35 weeks. Therefore, the result of the regression model for infants born < 32 weeks and 32—37 weeks gestation is not surprising. Infants which were breastfed after the first 14 days had significantly higher odds for MOM feeding at discharge compared to infants with first breastfeeding within the first 14 days or no breastfeeding attempt. The previously described degree of immaturity might explain this difference. This finding underlines the importance of maternal endurance in using a breast pump for a long time to ensure MOM feeding at the time of discharge. Understandably for term infants the odds are higher within the first 14 days.

Conclusions

By understanding and knowing potential risk factors for breastfeeding failure, targeted interventions in the NICU can be realized to promote mom's own milk feeding.

Parental education about benefits of breastfeeding and encouragement of the mother to continue breastfeeding or expressing milk via pumping for a long duration of hospital stay is essential to increase breastmilk feeding for hospitalized newborns until discharge. The continuous presence of nurses at the NICU positions them in an important role to support mothers and ensure that the infants receive human milk as their optimal nutrition. Education of health care professionals and improving their practical skills is as central as parental knowledge about human milk supply techniques and benefits. Through adequate interventions more infants might benefit from advantages associated with breast milk nutrition.

Abbreviations

BW: birth weight, CPAP: continuous positive airway pressure, GA: gestational age, LOS: length of stay, MOM: mom's own milk, NICU: neonatal intensive care unit, NMOM: non-mother's own milk,

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics Committee of the Faculty of Medicine, Technical University Dresden (EK 138032015). The Ethics Committee waived the need for consent. De-identified data was used for all analyses.

Consent for publication

Not applicable.

Availability of data and material

The datasets analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Funding was not available for this study.

Authors' contributions

NH contributed significantly to the design of the study, collected and analysed the data and drafted the manuscript. MR and LM designed the study, contributed significantly to the data analysis and reviewed the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1. Characteristics of the three study groups.

	< 32 weeks			32 – 36 weeks			≥ 37 weeks		
	NMOM (n=103)	MOM (n=148)	P	NMOM (n=108)	MOM (n=138)	P	NMOM (n=70)	MOM (n=56)	P
Length of stay (days)	58 (33; 84)	46.5 (30; 64)	**0.008**	19 (13; 75)	17.5 (12; 21.3)	0.202	7 (4; 11.3)	8 (5; 12)	0.180
GA in weeks	28 (26; 30)	29 (28; 31)	**0.019**	34 (33; 35)	33 (32.8; 34)	0.065	39 (38; 40)	39 (38; 40)	0.630
GA in weeks at discharge	36 (35; 39)	36 (35; 37)	**0.026**	35 (35; 37)	36 (35; 37)	**0.003**	40 (39; 41)	40 (39; 42)	0.413
BW in gram	1070 (840; 1500)	1265 (950; 1545)	0.067	2125 (1903; 2400)	1995 (1730; 2328)	**0.008**	3300 (2815; 3603)	3380 (2833; 3765)	0.538
First kangarooing (days)	9 (5; 16)	7 (5; 12)	**0.031**	3 (2; 5)	3 (1; 4)	0.169	1 (1; 2)	1 (1; 2.8)	0.427
Duration of nutrition via feeding tube (days)	50 (31.5; 74.5)	42 (27.8; 58)	**0.048**	13 (7; 18)	13 (6; 17)	0.852	0 (0; 0)	0 (0; 3)	0.229
First breastfeeding (days)	17 (12; 39)	23 (12; 44)	0.173	4 (3; 9.5)	5 (3; 8)	0.874	1 (1; 2)	1 (2; 4.8)	0.112
Number of antenatal obstetrical consultations attended	6 (4; 8)	6 (5; 8)	0.084	8 (6; 10)	8 (6; 10)	0.552	11 (8.5; 13)	11 (9; 13.5)	0.530
Length of stay in NICU (days)	21 (10; 44)	18 (8; 35.8)	0.096	4 (1; 7)	4 (2; 6)	0.883	0 (0; 2)	0 (0.5; 6)	0.069
Maternal age (years)	31 (27; 34)	31 (28; 34)	0.453	30 (27; 34.8)	30 (26.8; 35)	0.939	27 (24; 32)	30.5 (26; 33)	**0.030**
Maternal length of stay in hospital before delivery (days)	4 (1; 17)	4 (1; 16)	0.938	1 (0; 19)	4 (1; 21)	0.080	0 (0; 1)	0 (0; 1)	0.192
	Number (Percentage)								
First Breastfeeding None Within 14 days After 14 days	52 (50.5%) 18 (17.5%) 33 (32.0%)	21 (14.2%) 38 (25.7%) 89 (60.1%)	**< 0.001**	39 (36.1%) 65 (60.2%) 4 (3.7%)	6 (4.3%) 122 (88.4%) 10 (7.2%)	**< 0.001**	32 (25.4%) 37 (52.9%) 1 (1.4%)	4 (7.1%) 49 (87.5%) 3 (5.4%)	**< 0.001**
Smoking	22 (21.4%)	6 (4.1%)	**0.019**	15 (13.9%)	2 (1.4%)	**< 0.001**	20 (28.6%)	2 (3.6%)	**< 0.001**
Mother unpaired	7 (6.8%)	2 (1.4%)	**0.023**	4 (4.2%)	0	**0.018**	6 (11.5%)	1 (2.3%)	0.087

Missing information	6	9					18	13	
Caesarean section	97 (94.2%)	127 (85.8%)	**0.035**				28 (40.0%)	20 (35.7%)	0.623
Abdominal surgery	12 (11.7%)	7 (4.7%)	**0.041**	1 (0.9%)	0	0.257	0	0	-
No invasive mechanical ventilation	36 (35.0%)	70 (47.3%)	0.051	35 (32.4%)	43 (31.2%)	0.835	51 (72.9%)	31 (55.4%)	**0.041**
Academic profession Missing information	10 (9.7%) 20	29 (19.6%) 18	0.059	11 (12.6%)	21 (17.2%)	0.366	6 (15.0%) 30	8 (22.9%) 21	0.384
Discharged home	92 (89.3%)	120 (81.1%)	0.076	98 (90.7%)	130 (94.2%)	0.301	60 (85.7%)	50 (89.3%)	0.550
Singleton	75 (72.8%)	99 (66.9%)	0.317	63 (58.3%)	96 (69.6%)	0.067	68 (97.1%)	56 (100%)	0.202
Skin to skin contact in the delivery room Missing information	12 (11.7%) 14	24 (16.2%) 16	0.354	25 (27.8%)	34 (27.2%)	0.925	54 (78.3%) 1	30 (55.6) 2	**0.007**
No intraventricular haemorrhage	79 (76.7%)	122 (82.4%)	0.470	105 (97.2%)	130 (94.2%)	0.087	66 (94.3%)	52 (92.9%)	0.532
Intubation during resuscitation	33 (32.0%)	51 (34.5%)	0.669	14 (13.0%)	12 (8.7%)	0.280	6 (8.6%)	5 (8.9%)	0.944
Assisted conception	13 (12.6%)	18 (12.2%)	0.913	15 (13.9%)	19 (13.8%)	0.978	4 (5.7%)	2 (3.6%)	0.575
No siblings	60 (58.3%)	87 (58.8%)	0.933	65 (60.2%)	85 (61.6%)	0.822	45 (64.3%)	25 (44.6%)	**0.027**
Pump feed ≥ 30 minutes	97 (94.2%)	139 (93.9%)	0.933	45 (41.7%)	50 (36.2%)	0.385	9 (12.9%)	11 (19.6%)	0.3
Admission < 48 hours of life	6 (5.8%)	9 (6.1%)	0.933	13 (12.0%)	7 (5.1%)	**0.047**	20 (28.6%)	22 (39.3%)	0.205
Gestational diabetes	9 (8.7%)	13 (8.8%)	0.990	16 (14.8%)	7 (5.1%)	**0.009**	11 (15.7%)	6 (10.7%)	0.414

GA: Gestational age, BW: birth weight.

Table 2 – Risk factors for MOM feeds at discharge.

	< 32 weeks			32 – 36 weeks			≥ 37 weeks		
	Odds ratio	95% confidence interval	p	Odds ratio	95% confidence interval	p	Odds ratio	95% confidence interval	p
Smoking	0.273	0.076 – 0.989	0.048	0.179	0.031 – 1.031	0.054	0.264	0.049 – 1.428	0.122
First breastfeeding Within 14 days After 14 days	4.999 8.426	1.600 – 15.617 3.362 – 21.118	0.006 < 0.001	8.517 29.969	3.258 – 22.267 4.552 – 197.325	< 0.001 < 0.001	11.774 -	2.89 – 47.974 -	0.001 -
Caesarean section	0.236	0.058 – 0.967	0.045	-	-	-	-	-	-
Gestational Diabetes	-	-	-	0.194	0.066 – 0.564	0.003	-	-	-
Birth weight	-	-	-	0.999	0.998 – 1.000	0.023	-	-	-

Figures

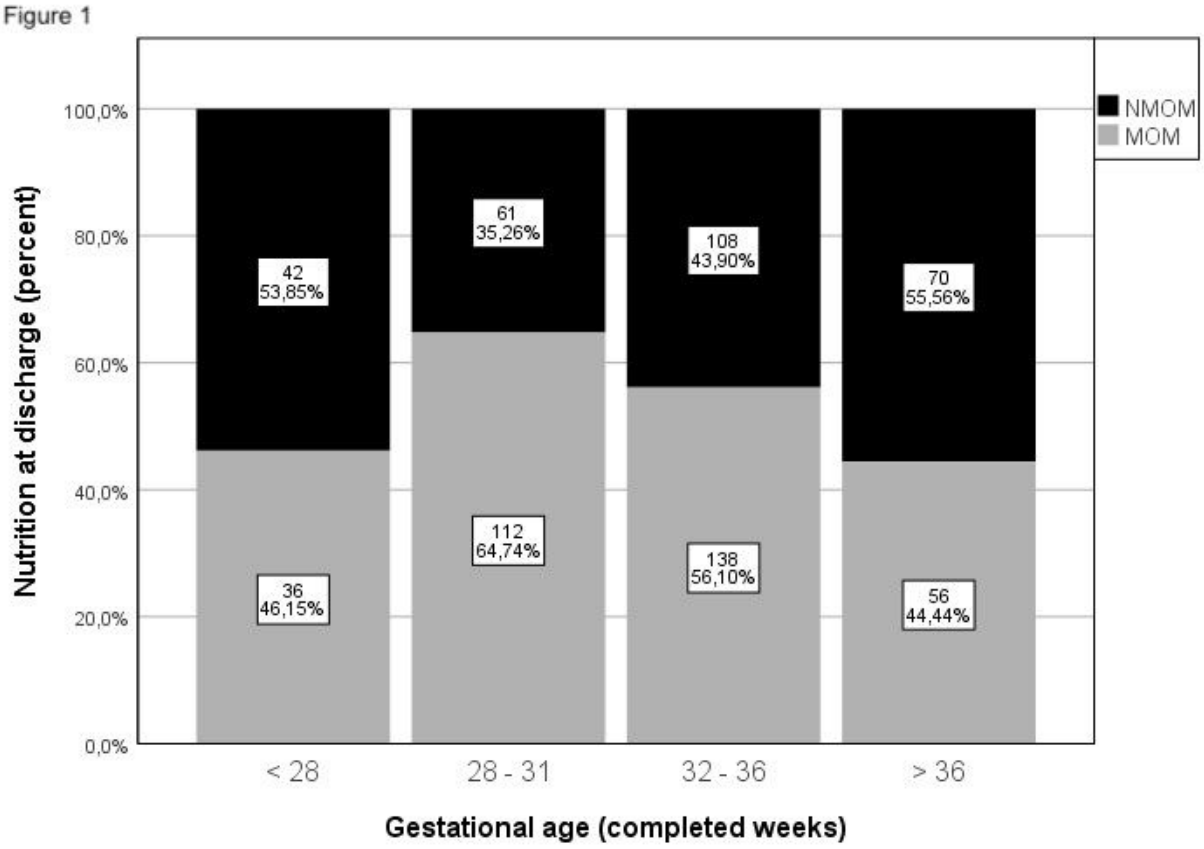

Figure 1

Association between gestational age and MOM feeds at discharge