

Determinants of VLBWs' Nutrition with Maternal Milk

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The low prevalence and short duration of Mother's Own Milk (MOM) feeding among Very Low-Birth-Weight infants (VLBW) infants have been associated with several factors. Several studies have shown that mothers who are not married, younger, have a lower educational level, are smokers, multiparous and do not attend prenatal care are less likely to feed their infants with MOM. Furthermore, infants with a lower gestational age, lower birth weight, severe neonatal morbidities and longer hospital stays are less likely to be fed with breast milk. The European EPICE cohort has also explored the maternal, obstetric and infant factors, as well as the maternal and neonatal unit policies that may influence MOM feeding at hospital discharge. Vaginal delivery, singleton delivery and MOM consumption at the first meal have been associated with exclusive MOM feeding, while a positive association with any MOM feeding at discharge is described for factors such as the administration of prenatal corticosteroids, primiparity, timing < 24 h after birth before the first enteral feeding and MOM consumption at the first meal.

Keywords: very low birth weight ; prematurity ; mother's own milk nutrition ; human milk

1. Non-Modifiable Factors

A young maternal age is often considered a risk factor for the lack or absence of MOM feeding at discharge. In a population of preterm infants <34 weeks GA, each year of maternal age was associated with a 1.24-fold increase in breastfeeding at discharge ^[1]. In another report ^[2], mothers aged under 25 years stopped breastfeeding more often before discharge and before six months than mothers older than 25 years. This age limit is frequently indicated; in fact, in a further study, infants with mothers younger than 25 were 30% less likely to be breastfed than children with older mothers ^[3].

The EPICE Research Group, in a logistic analysis, found an association between exclusive breastfeeding at discharge and two factors, which are the young age of the mother and the early onset of oral nutrition ^[4]. This association has also been found in an Italian survey ^[5].

Gestational age is also one of the most considered elements. For example, preterm babies < 28 weeks GA had a 2.9 times greater risk of exclusive breastfeeding failure ^[6]. In the previous publication ^[7] focused on the amount of donated milk, the data analysis revealed that the maternal age, profession of the donors, and birth weight of their children had a statistically significant impact on the Donor Milk (DM) volume, while the gestational age of the donors' children influenced the milk donation volume; however, this lacked statistical validity.

Data on multiple births are controversial because some studies show an association with exclusive breastfeeding ^[8], while others ^{[1][6][9]} show a correlation with Formulated Milk (FM) feeding or the more frequent discontinuation of breastfeeding before six months of age.

In the NICU ^[10], the percentage of twins almost doubled between 2015 and 2020. In total, 18.1% of twins received breast milk for more than 6 months and 6.3% for more than 12 months. It is worth reporting that twins of lower gestational age and weight, born to multiparous, more mature and educated mothers, received breast milk for a longer period.

In another study ^[11], the MOM feeding rates at discharge were associated with a higher gestational age at birth, with better outcomes among those born at 29–32 weeks GA compared to those <26 weeks GA. Other determinants associated with a poorer MOM feeding rate at discharge were birth to primiparous mothers or birth to mothers with diabetes.

In studies ^[12] conducted in the United States, the mother's marital status is often assessed, and the results are not univocal. In full-term infants, married women started and maintained breastfeeding longer than single mothers ^[13], while in another report ^[8], unmarried women started feeding premature babies with MOM more often and more often provided

breast milk until discharge. In another study ^[14], children of married mothers were discharged more frequently with MOM feeding. European studies rarely mention the mother's marital status; thus, no data are available in this regard.

The socioeconomic status of the mother influences breastfeeding in both full-term and preterm infants: mothers with a lower level of education or with less access to care stop breastfeeding earlier at discharge ^[15] and before six months ^[16]. In European countries ^[1], low maternal education has been indicated as a key risk factor for breastfeeding cessation. In contrast, another study found that the age, academic qualifications or parity of the mother were not associated with different rates of MOM feeding at discharge ^[2].

In a large cohort ^[17] from 124 NICUs in the United States, an older maternal age, white race, greater gestational age and the site of care were significant predictors of increased MOM use at discharge. In California, the absence or shortage of prenatal care, a young maternal age, and Hispanic and African American heritage were associated with higher rates of FM feeding at discharge for VLBWs ^[18].

In another series ^[1], younger and less educated mothers were more likely to stop breastfeeding before 6 months. In addition, other factors such as multiple birth, BPD and neonatal transfers impacted the probability of MOM feeding continuation. Among them, two neonatal factors negatively influenced MOM feeding maintenance: BPD and neonatal transfers ^[19].

In a report ^[20] in which the association of MOM feeding with natural pregnancies or assisted fertilization was studied, the factors associated with the early cessation of MOM feeding were smoking during pregnancy, birth weight ≥ 1000 g, gestational age ≥ 29 weeks, single-mother status, a short (<12 years) duration of maternal or paternal school education and natural conception.

2. Modifiable Factors

It is easy to understand that the frailty, vulnerability and limited neurological competence of preterm infants could compromise MOM use and breastfeeding in a neonatal intensive care unit, but other modifiable factors have been well described. These are, for instance, mother/baby separation, the anxiety and stress accompanying the birth of a high-risk baby, the mother's difficulty expressing milk and the potentially suboptimal performance of the NICU staff ^[21].

Hospitalization in an NICU and the separation of the mother–child dyad are significantly associated with reduced rates for the initiation and frequency of breastfeeding ^{[22][23]}. Also, previous breastfeeding experiences have protective effects on breastfeeding in the NICU. In particular, it was found that women who have not previously breastfed are 5.6 times more likely to stop exclusive breastfeeding before discharge than those who have previously breastfed for at least 4 months ^[6].

The use of MOM at discharge is associated with higher rates of continued breastfeeding in the following months. Premature infants discharged with breast milk and formula were half as likely to be breastfed at 6 months compared to those who received only breast milk at discharge ^[24].

The first week is important for the success of feeding with MOM. This is confirmed by a study attesting that, in babies born between 23 and 31 weeks of gestation, a high intake of breast milk during the first postnatal week is associated with higher rates of nutrition with exclusive MOM at 36 weeks ^[25].

The reception of MOM by day 3 of age was the main predictor of breastfeeding at discharge ^[11].

It is worth mentioning that it is useful to start trophic feeding with breast milk, improving both structural and functional gastrointestinal development in the preterm. The early availability of milk also facilitates the oropharyngeal administration of colostrum, which can reduce clinical sepsis ^[26]. The early expression of breast milk plays a similar role in the early initiation of breastfeeding in term infants, for the success of exclusive breastfeeding ^[27].

Only 3.3% of mothers of preterm children started breast expression within an hour of delivery in a study conducted in Northern India ^[28].

A cross-sectional study conducted in Finland revealed that 36% of mothers begin expressing breast milk within six hours of birth ^[29], while a study conducted in Japan showed that only 17% of mothers start expressing milk within six hours of delivery.

In the NICU, we try to start minimal enteral feeding with bank milk as soon as possible and, when clinical stability allows it, within the sixth hour of life. Immediately after premature birth, mothers receive the breast pump kit and information about

the breast stimulation protocol. This provides the mother with first access to the kit of extraction within 6 h of birth and then every 3 h, in order to obtain adequate breast stimulation that favors the production of colostrum. When breast milk becomes available, DM is replaced by MOM. Daily increases in milk volumes are planned by a dedicated protocol and are adapted according to the clinical condition and the degree of compliance with enteral feeding.

An important role is played by the emotional challenges of mothers after premature birth ^{[30][31]}. Acting on conscious motivation is one of the paths that is most destined for success. It has been shown that the active involvement of the mothers of VLBWs, through the transmission of information on the benefits of using MOM for premature babies and advice on milk extraction and breastfeeding practices, is not a cause of additional stress. Indeed, it is a simple and easily achievable way to make these women co-protagonists of the care of their children, in every moment of life in the NICU, even in the most critical situations ^{[32][33]}.

Infants with valid direct breastfeeding at discharge are breastfed longer than those receiving feeding bottles ^{[34][35]}.

Research also reports that mothers with insufficient breastfeeding in the NICU experience many more breastfeeding-related challenges after discharge ^{[36][37][38]}. For this reason, all methods that have proven their effectiveness in promoting breastfeeding initiation in the NICU should be recognized, enhanced and standardized ^{[7][39]}.

A study ^[28] conducted in Shanghai showed that the objective of prolonged exclusive breastfeeding is affected by many factors acting at the individual, family and social levels, and that targeted intervention measures should focus on these three levels.

According to the literature, NICU practices are largely responsible for premature infants' lack of breast milk intake and/or the early cessation of exclusive breastfeeding ^[29].

A lack of effective communication, counseling and breastfeeding support contributes to a significant delay in the availability of MOM ^[36].

Exclusive nutrition with MOM has increased in NICUs with dedicated spaces and breastfeeding support staff ^{[37][40]}.

In fact, effective interventions to promote breastfeeding and HM use in neonatal intensive care are well known, although they are applied inconsistently: (1) free access of parents to the NICU ^{[41][42]}, (2) adequate knowledge of the topic of breastfeeding, (3) peer support at the hospital, (4) promotion of breast feeding and assistance to mothers during Kangaroo Mother Care (KMC), and (5) a clear plan encouraging breast milk expression, accompanied by the active promotion of this practice ^[43].

KMC is a comprehensive intervention; it is suitable and useful, as well as being the most feasible and preferred intervention used to reduce neonatal morbidity and mortality. It is the most effective way to promote the early onset of breastfeeding ^[38].

Systematic reviews and meta-analyses have shown that the KMC certainly has positive effects on growth and breastfeeding rates in VLBW ^{[7][44]} infants. Therefore, KMC for preterm and low-birth-weight infants must be systematically promoted and supported by all health facilities that welcome them.

The main challenges associated with supporting breastfeeding in the NICU were the lack of facilities able to support the opening of NICUs to parents, barriers to breast milk expression and administration, and a high FM feeding rate. Long-distance commuting to the NICU adversely affected mothers' proximity to their babies and also breast milk extraction and transport frequency ^[2].

In our NICU, there is an adjacent room for the accommodation of mothers of premature babies, as well as a dedicated place for milk extraction, and this factor has been proven to be one of the most elements that has the greatest impact on the possibility of feeding VLBWs with MOM.

Mothers' intention to breastfeed had a significant impact on the duration of milk expression and breastfeeding ^[45].

Mothers and families of children in NICUs should receive both integrated psychological/motivational and practical support.

The partner's support in the supply of breast milk also promotes the mother's motivation ^[2].

A qualitative study ^[46] suggests how fathers can support the MOM feeding of a premature infant. Caregiver intervention in the first days of life through targeted information and practical advice can help fathers to get involved in this process.

In a study ^[47] carried out in a Kangaroo Mother Care Unit, it was confirmed that this practice increased the direct breastfeeding rates of preterm infants and its efficacy, and had a positive influence on mothers' intention to continue breastfeeding following discharge and to breastfeed exclusively for six months. The importance of the NICU staff and KMC unit's role in mothers' readiness and confidence to breastfeed beyond discharge was emphasized.

It is also said that health professionals should identify mothers at high risk of the early cessation of breastfeeding, and dedicate supportive interventions to reducing the barriers that prevent this subpopulation of mothers from feeding their premature babies with MOM. All NICUs, as a priority, should have established procedures for breastfeeding protection and support, and practical/organizational methods to facilitate the expression and transport of breast milk. The family-centered NICU has been a main focus of care promoted by all neonatal scientific societies.

DM availability ^[48] is considered as another effective element in promoting feeding with MOM, also through an earlier start to enteral feeding in VLBWs.

These findings are summarized in **Table 1**.

Table 1. Factors affecting MOM use.

FACTORS	EFFECTS		
	Less MOM	More MOM	References
Non-Modifiable Factors			
Maternal Age	Younger		[1][2][3][9][17][49][50]
Gestational Age	Lower		[6][9][11][17][49]
Birth weight	Lower		[9]
Parity	Multiparous		[3][9][49][50]
	No effect		[2]
Ethnicity and race			
Hispanic	Lower		[17][18]
African			
Multiple Birth	X		[1][6][9]
		X	[8]
Marital status	Not married		[3][9][13][14][20][49][50]
		Married	[8]
Educational status	Lower		[1][3][9][15][16][20][49][50]
Morbidities	Severe		[9][19][49]
Type of Conception	Natural		[20]
Modifiable Factors			
Smoke	X		[3][9][20][49][50]
Prenatal Care	Poor or absent		[3][9][49][50][51]

FACTORS	EFFECTS		
	Less MOM	More MOM	References
Maternal/neonatal unit policy	Dyad separation		[9][21][22][23][50][51] [52][53][54]
	Stress, difficulty in expressing milk		[21][30][31]
	Long hospitalization		[9][22][23][49]
		MOM at discharge	[24]
	Lack of communication, counseling Lack of breastfeeding support		[36][37]
	Lack of mother's proximity		[2]
		Dedicated spaces	[37][40]
		Free access of parents	[41][42]
		MOM within day 3 of age	[11]
		High intake of MOM during the first postnatal week	[25]
		Breastfeeding at discharge	[34][35]
		Availability of DM	[48][52]
		Active breastfeeding promotion/support of staff	[3][9][43][50][51][53] [54][55]
		Baby-Friendly Hospital accreditation	[52][55]
		Support of partner and family	[2][46]
		KMC	[3][38][39][44][47]
Previous breastfeeding experience	No previous breastfeeding (5–6 times more likely to stop before discharge)		[6]

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