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Article

# Feeding VLBWs with Mother's Own Milk. Italian Monocentric Analysis

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**Abstract:** Mothers' own milk (MOM) for premature babies is considered a life-saving drug for its proven protective action against the complications of prematurity and for the effects on the outcome in the short and long term, especially the neurological one. We studied the use of the MOM for VLBWs over a 5-year period. Statistical comparisons concerned data on feeding with the MOM during stay in NICU and at discharge with respect to maternal and neonatal variables (gestational age, birth weight, type of pregnancy if single or twin, maternal age) and to feeding data (timing of the start of the Minimal Enteral Feeding and the availability of the MOM, the achievement of the Full Enteral Feeding, the type of nutrition at discharge). We observed an increase, between 2017 and 2021, of MOM use ( $p=0.003$ ). The availability of the MOM occurred on average on the fourth day of life and improved over the years. Start of MEF with human milk averaged 1.78 days and 54.3% of VLBWs received MEF with donor milk on the first day of life (50% within the first 6 hours). The average MOM at discharge was 47.6% with 36.1% exclusive MOM (EMOM) and an increase from 45.8% in 2017 (EMOM 33.3%) to 58.82% (EMOM 41.18%) in 2021. The mean average daily growth of the weight improved ( $p<0.001$ ) during this period. There is no statistical difference between infants fed with MOM and those fed with bank milk. The maternal age, the start day of the MOM feeding and gestational age have a significant impact on the type of feeding at discharge.

**Keywords:** mothers' own milk; preterm feeding; VLBW

## 1. Introduction

Preterm birth is the leading cause of death under five years of age, responsible for about one million deaths in 2015<sup>1-3</sup>. There was a wide variation in preterm birth trends in European countries<sup>4</sup>. Preterm and low birth weight infants are among the most vulnerable in our society<sup>5</sup> and deserve special attention as well as a greater commitment to care in all aspects, especially nutritional ones which impact mortality and morbidity. MOM for premature babies is considered an important opportunity of life and health because it reduces the risk of major complications of prematurity, but also an investment for life for its long-term outcomes including neurological and cognitive ones<sup>6-8</sup>. Much has changed over the years on the awareness that a correct nutritional practice in the early periods of life can affect the present and future well-being<sup>7,8</sup>. Scientific evidence regarding the benefits of human milk is recognized by the world's leading health authorities and international bodies<sup>9-11</sup>.

In fact, even politics both nationally and internationally has given and is giving important contribution to the promotion of breast feeding with official statements, specific dedicated documents, guidelines, reports. So small signs of a greater diffusion of breast milk use in NICUs are recorded, of which, moreover, it is also a recognized index of quality. The exception is Sweden<sup>12</sup>, one of the most historically virtuous countries on breastfeeding, where the percentage of ELBW babies fed at discharge with MOM went from 55% in 2004 to 16% in 2016.

If the data of the type of feeding at discharge is more present in the literature, what concerns the first weeks of life in NICU, crucial for the development of VLBWs, is sparse. We refer to the nutrition with the MOM obtained by expressing the breast and then directly to the breast.

In this study we evaluated the three key moments of nutritional care in NICU: the start of enteral feeding, the achievement of FEF and the type of feeding at discharge.

## 2. Description of the study

### 2.1. Objectives: Evaluate

n° VLBWs fed with MOM in the first weeks of life, n° VLBW discharged with MOM, a correlation between maternal and neonatal factors with MOM feeding; **Analyze**: the start times of the MEF with DM and with MOM, the timing of reaching the FEF; the trend over years of the feeding with MOM during hospitalization and discharge.

The last aim is to identify the margins for improvement in nutrition performance with MOM with actions aimed at the categories most at risk of not receiving their mother's milk.

### 2.2. Design, setting and methods

The sample includes VLBWs admitted to the NICU from 2017 to 2021. 97 VLBWs were recruited.

We obtained informed consent from mothers with a dedicated and signed form.

Transferred infants, babies with malformations with intrinsic interference with nutrition and those born to mothers with pathologies incompatible with milk production and extraction were excluded.

Nutrition with MOM during hospitalization means a minimum of 2 continuous weeks with exclusive or prevalent MOM (MOM>50%).

The data have been extrapolated from medical records, care cards and HMB's databases, and relate to the **variables**: *neonatal and maternal data*: GA, BW, type of pregnancy if single or twin, MA; *feeding data*: timing of: the start of the MEF, the availability of the MOM, the achievement of the FEF; the type of nutrition at discharge and data relating to the length of stay and weight increase. Statistical comparisons concerned data on feeding with MOM in the NICU and at discharge with respect to variables.

Demographical and clinical characteristics were reported as mean and standard deviation for continuous variables and as frequency and percentage for categorical variables.

Group comparisons were performed using ANOVA or t-test for continuous variables and Pearson chi-squared test or Fisher exact test for categorical variables.

A p-value <0.05 was considered as statistically significant. All analyses were performed using the software R-project.

### 2.3. Results

The characteristics of the sample of the 97 VLBWs recruited are summarized in Table n° 1 while the trend over the years is represented in Table No. 2.

The average maternal age was 32.62 years, but it grew over the years from 31.86 years in 2017 to 35.65 years in 2021.

69.5% of mothers of premature babies provided their own milk.

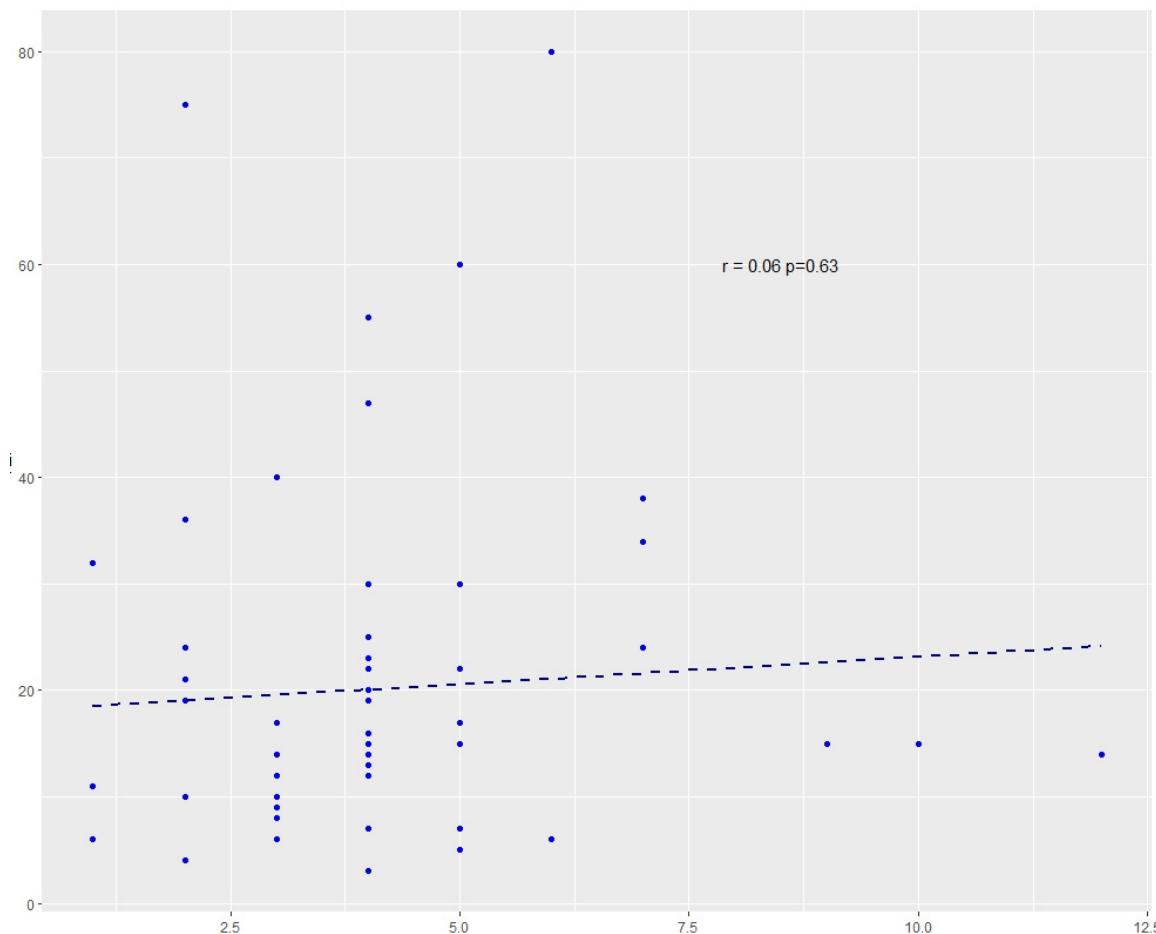
We observed an increase, between the year 2017 and 2021, of MOM users ( $p=0.003$ ) although the low percentage in 2020 is probably due to the small number of observations in this year.

In particular, the percentage of feeding VLBWs with MOM has grown over the years in a statistically significant way, with a positive peak of over 91% in 2019, and a negative trend of 14.9% in 2020, the year of the Covid pandemic.

The availability of the mother's milk occurred on average on the fourth day of life; over the years it improved, occurring on the third day in 2021.

Initiation of MEF with human milk averaged 1.78 days. 54.3% of VLBWs received MEF with DM on the first day of life (50% within the first 6 hours) and 36.9% on the second day while MEF with MOM started on day 2 for 10%, on day 3 for 21.6% and between the 4<sup>th</sup> and 5<sup>th</sup> day for 51.6%.

On an average stay of 62 days, the achievement of the FEF occurred in 18 days, and a median of 14. 26 (26.8%) out of 97 reached the FEF within the tenth day of life. The trend of the FEF compared to the start of the MOM availability is shown in Figure 1.



The average MOM feeding at discharge was 47.6% with 36.1% exclusive with an increase from 45.8% in 2017 (EMOM 33.3%) to 58.82% (EMOM 41.18%) in 2021.

The average daily weight gain was 24 grams, with an increase over the years from 21.08 grams in 2017 to 31.36 grams in 2021. Moreover, we also observed a growth of the mean weight increase ( $p < 0.001$ ) during this period. There is no statistically significant difference between infants fed with their mother's milk and those fed with bank milk.

There was no statistical significance of gestational age, weight, type of delivery and pregnancy if single or twin and maternal age on the availability of MOM during hospitalization (Table n° 3).

The maternal age and the onset of breast milk have a statistically significant impact on the type of feeding at discharge (Table n° 4) if the three categories (EMOM, MMOM, FM) are distinguished and, if two HM groups (EMOM + MMOM) and FM are compared, gestational age at birth is also significant.

All patients discharged with BM alone or BM with FM, started with MOM feeding earlier than those discharged with preterm formula ( $p = 0.032$ ).

Overall (N=97)	
GA	
Mean (SD)	28.56 (2.73)

		Overall (N=97)
Median (Q1, Q3)		29.00 (27.00, 30.00)
Min - Max		23.00 - 35.00
Non missing N		97
<b>Birth Weight</b>		
Mean (SD)		1091.48 (287.93)
Median (Q1, Q3)		1110.00 (870.00, 1320.00)
Min - Max		520.00 - 1495.00
Non missing N		97
<b>Year</b>		
2017		24 (24.7%)
2018		24 (24.7%)
2019		24 (24.7%)
2020		8 (8.2%)
2021		17 (17.5%)
Non missing N		97
<b>Single/Twin</b>		
T		36 (37.5%)
S		60 (62.5%)
Non missing N		96
Missing N		1
<b>Delivery</b>		
V		14 (14.6%)
CS		82 (85.4%)
Non missing N		96
Missing N		1
<b>MA</b>		
Mean (SD)		32.62 (6.11)
Median (Q1, Q3)		33.00 (28.50, 37.50)
Min - Max		19.00 - 46.00
Non missing N		95
Missing N		2
<b>DM m1</b>		
Mean (SD)		4015.88 (3840.05)
Median (Q1, Q3)		2900.00 (500.00, 7100.00)

Overall (N=97)	
Min - Max	12.00 - 12200.00
Non missing N	68
Missing N	29
<b>Start MEF</b>	
Mean (SD)	1.78 (1.03)
Median (Q1, Q3)	2.00 (1.00, 2.00)
Min - Max	1.00 - 7.00
Non missing N	96
Missing N	1
<b>MOM</b>	
NO	29 (30.5%)
YES	66 (69.5%)
Non missing N	95
Missing N	2
<b>Start MOM</b>	
Mean (SD)	4.11 (1.93)
Median (Q1, Q3)	4.00 (3.00, 5.00)
Min - Max	1.00 - 12.00
Non missing N	65
Missing N	32
<b>FEF</b>	
Mean (SD)	18.53 (14.30)
Median (Q1, Q3)	15.00 (9.00, 22.00)
Min - Max	3.00 - 80.00
Non missing N	86
Missing N	11
<b>Days of hospitalization</b>	
Mean (SD)	62.14 (25.76)
Median (Q1, Q3)	58.00 (45.25, 76.00)
Min - Max	22.00 - 161.00
Non missing N	94
Missing N	3
<b>Weight at discharge</b>	
Mean (SD)	2538.55 (529.59)

Overall (N=97)	
Median (Q1, Q3)	2390.00 (2157.50, 2802.50)
Min - Max	1781.00 - 4960.00
Non missing N	96
Missing N	1
<b>Feeding at discharge</b>	
FM	51 (52.6%)
MOM	35 (36.1%)
MOM+FM	11 (11.3%)
Non missing N	97
<b>Average daily weight increment</b>	
Mean (SD)	24.02 (7.22)
Median (Q1, Q3)	23.00 (19.67, 26.85)
Min - Max	12.20 - 71.30
Non missing N	92
Missing N	5

Table n° 2. Trend over the years.

Year	2017	2018	2019	2020	2021	p
n°	24	24	24	8	17	
GA (mean (SD))	27.29 (2.37)	28.58 (2.89)	29.00 (2.59)	29.25 (3.28)	29.35 (2.57)	0.09 7
Weight (mean (SD))	1030.00 (316.32)	1085.46 (281.31)	1139.29 (298.99)	1052.50 (243.35)	1137.65 (270.64)	0.68 0
Sing_Twins = S (%)	17 (70.83)	16 (66.67)	15 (65.22)	5 (62.50)	7 (41.18)	0.37 2
CS (%)	18 (78.26)	21 (87.50)	18 (75.00)	8 (100.00)	17 (100.00)	0.11 7
Maternal age (mean (SD))	31.86 (6.15)	32.38 (6.98)	31.04 (5.71)	33.75 (4.13)	35.65 (5.48)	0.16 8
MOM = YES (%)	16 (66.67)	15 (62.50)	21 (91.30)	1 (14.29)	13 (76.47)	0.00 3

<b>Start MOM (mean (SD))</b>	4.44 (2.16)	4.47 (2.53)	4.00 (1.63)	4.00 (0.00)	3.30 (1.16)	0.60 2
<b>DM ml (mean (SD))</b>	3211.25 (3324.12)	4599.29 (4045.35)	3200.57 (3510.58)	9883.33 (2116.99)	2125.00 (1935.94)	<0.0 01
<b>Start MEF (mean (SD))</b>	1.52 (0.73)	2.04 (1.40)	1.67 (0.48)	2.38 (1.92)	1.65 (0.61)	0.18 0
<b>FEF (mean (SD))</b>	22.77 (21.76)	15.58 (7.37)	16.22 (10.72)	20.88 (14.95)	19.89 (12.75)	0.43 3
<b>Length of stay (mean (SD))</b>	65.71 (30.32)	68.54 (28.76)	60.58 (22.10)	59.50 (19.34)	52.12 (21.49)	0.33 1
<b>Average daily weight increment (mean (SD))</b>	21.08 (3.44)	22.27 (4.46)	23.83 (5.72)	21.55 (3.95)	31.36 (11.25)	<0.0 01

GA: Gestational Age, MOM: Mother's Own Milk, CS: Cesarean Section, MEF: Minimal Enteral Feeding, FEF: Full Enteral Feeding, DM: Donor Milk.

Table n° 3. MOM feeding during hospitalization.

	<b>NO</b>	<b>YES</b>	<b>p</b>
<b>n°</b>	<b>29</b>	<b>66</b>	
<b>GA (mean (SD))</b>	29.28 (2.95)	28.23 (2.57)	0.084
<b>Weight (mean (SD))</b>	1169.24 (291.62)	1059.64 (281.78)	0.087
<b>Sing_Twins = S (%)</b>	14 (50.00)	44 (66.67)	0.198
<b>CS (%)</b>	24 (82.76)	56 (86.15)	0.910
<b>Maternal Age (mean (SD))</b>	32.00 (7.19)	32.83 (5.68)	0.553
<b>Start MOM (mean (SD))</b>	3.00 (2.83)	4.07 (1.84)	0.429
<b>Length of stay (mean (SD))</b>	57.34 (27.31)	64.59 (25.00)	0.213
<b>Average daily weight increment (mean (SD))</b>	23.38 (4.44)	24.43 (8.26)	0.527
<b>Start MEF (mean (SD))</b>	1.90 (1.18)	1.72 (0.98)	0.457
<b>FEF (mean (SD))</b>	14.88 (7.30)	19.53 (15.73)	0.162

GA: Gestational Age, MOM: Mother's Own Milk, CS: Cesarean Section, MEF: Minimal Enteral Feeding, FEF: Full Enteral Feeding.

Table n° 4. Feeding at discharge.

	<b>FM vs MOM vs MOM+FM</b>	<b>FM vs MOM</b>
	<b>p</b>	<b>p</b>
<b>GA (mean (SD))</b>	0.101	0.032
<b>Weight (mean (SD))</b>	0.182	0.065
<b>Sing_Twins = S (%)</b>	0.584	0.460

<b>CS (%)</b>	0.323	0.538
<b>Maternal Age (mean (SD))</b>	0.048	0.059
<b>Start MOM (mean (SD))</b>	0.032	0.009
<b>Length of stay (mean (SD))</b>	0.622	0.733
<b>Average daily weight increment (mean (SD))</b>	0.845	0.562
<b>Start MEF (mean (SD))</b>	0.719	0.670
<b>FEF (mean (SD))</b>	0.225	0.620

GA: Gestational Age, MOM: Mother's Own Milk, CS: Cesarean Section, MEF: Minimal Enteral Feeding, FEF: Full Enteral Feeding, FM: Formulated Milk.

### 3. Discussion

Preterm infants are a high-risk population and prematurity is a leading cause of neonatal morbidity and mortality. Feeding with breast milk during first days and months, is one of the factors that most impact the health of these vulnerable infants, as it reduces the incidence and severity of complications associated with prematurity and their related costs<sup>13-15</sup>. In addition, exposure to MOM, particularly in the first weeks of life, also improves long-term outcomes, especially the neurodevelopment<sup>16-18</sup>, and reduces disease and rehospitalization rates in the first year of life<sup>15</sup>. These effects are attributable to immunological, antimicrobial, anti-inflammatory, antioxidant, epigenetic, growth-promoting, and intestinal colonizing functions exerted by multiple bioactive factors, many of which are present in higher concentrations in the breast milk of mothers of preterm infants<sup>6</sup>. The protective action is a dose-response relationship, with higher and prolonged doses of MOM providing maximum protection<sup>19</sup>. Breast milk exposure rates vary widely between studies.

The first discussion item is just the fragmentation and **inhomogeneity** of the data on this topic, which instead is fundamental in the care of infants in NICU because it conditions their survival, their outcome and therefore their future. In the literature, there are monocentric reports like this and rare and unsystematic multicenter reports or data from national or international registers. Institutions dealing with child health should plan a program of constant monitoring of this aspect of life in NICU, which starts from the individual realities and extends to nations and continents.

Besides, the analysis of each center and the sharing of data also has its value for improving quality, whose tools cannot disregard from the collection, analysis, understanding and communication of data.

The percentages of **feeding with MOM** of 69.5% recorded in our NICU are not satisfactory but better than the European<sup>20-24</sup> (France 49%, Germany 47-60%, 44% in Portugal, 53.6%-78% in Greece, 49% in Sweden) and the Chinese<sup>25</sup> data (58%) and in line with those of the United States<sup>26-28</sup> (70%-75%); above all, they are values that have been growing over the years except for 2020, the year of the Covid 19 pandemic. This trend is common to other countries that recorded a 10-20% increase over the years<sup>20</sup>. In contrast is the resounding data of Sweden<sup>12</sup>, which has gone from 55% of exclusive feeding with MOM of very preterm babies in 2004 to 16% in 2013, from 41% to 34% in preterm newborns between 28 and 31 weeks and from 64% to 49% in moderately preterm infants (GA 32-36 weeks).

The most virtuous model remains Brazil, which has national standardized the integrated system of assistance in NICU and promotion of breastfeeding and donation, which it also exports to other states. In Brazil<sup>29</sup> the prevalence of exclusive breastfeeding was 65.2% at discharge, 51% at 3 months, and 20.6% at 6 months.

Our data confirm the devastating effect of the **pandemic** on feeding babies with MOM (Table n°2), as well as the dramatic reduction in milk donation. In 2020 the phenomenon was so important that all associations and scientific societies drew up documents to try to remove fears, reassuring about breastfeeding and revive the spirit of generosity of women who have a surplus of milk. In contrast with the general trend, in our HMB<sup>30</sup> milk donations grew in those critical months. Most probably this result was due to the spirit of solidarity which was very strong in the first period

together with the sharing of our HMB with women donors which has never stopped and actually strengthened during those difficult days.

**Initiation of MEF with DM** averaged 1.78 days and **with MOM** 4.11 days. In our study, the start MEF with MOM has been improving over the years, from an average of 4.44 days to 3.3 days. The start of feeding with MOM was a factor that significantly influenced the type of milk at discharge ( $p=0.009$ ), in line with other authors<sup>28</sup> who found that the main predictor of breastfeeding at discharge was the reception of MOM by the third day of age. It is known that the first hours and days after birth are a decisive moment for the start of breastfeeding.

Although there is no clear consensus in the guidelines regarding EF, more reports recommend the early and progressive EF<sup>31-39</sup>. In particular, it is advisable to start in the first 6 hours<sup>40</sup>, if the clinical conditions allow it, and in any case within the first 24-72 hours of life. Initiation of enteral feeding within 72 hours of birth<sup>41,42</sup> appears to reduce mortality, risk of sepsis, of bronchodysplasia, and length of hospital stay. To have maternal colostrum readily available, it is important to avoid a delay in secretory activation, also because the transition from differentiation to secretory activation within 72 hours of birth has an impact on long-term milk production<sup>43</sup>. Early, frequent, and effective expression is crucial for both the effect on health and on the duration of breastfeeding.

It is believed that for premature babies the early expression of breast milk has a value comparable to the early onset of breastfeeding for full-term infants on the success of prolonged exclusive breastfeeding. Parker et al<sup>44</sup> reported that first milk expression within 8 hours was superior to 9-24 hours with respect to maximal duration of provision of mother's milk for hospitalized VLBW infants, but emphasizes that to establish the causal relationship between timing of first milk expression and long-term lactation success, randomized control trials are needed.

This suggests intensifying compliance with the breast stimulation protocol that recommends starting within 6 hours of delivery<sup>43</sup>. In this study, the data of the time of the first breast stimulation is missing. However, data in the literature show unsatisfactory percentages for mothers who start expressing milk within 6 hours of delivery (36% in Finland<sup>45</sup>, 17% in Japan<sup>46</sup>, 3.3% in India<sup>47</sup>).

The most effective intervention to achieve the objective of an early and frequent expression of milk is the preventive information. When mothers receive adequate information, with scientific and practical content, about the importance of their breast milk, the results are more satisfactory<sup>48</sup>.

In our maternity unit, all women after premature birth are equipped with a breast pump, along with indications and recommendations on the practice of systematic breast stimulation; nevertheless, we would like to emphasize that the care of mothers on this aspect, ranging from information to systematic dialogue, monitoring of milk production and support for extraction and direct breastfeeding, must become central in the day-to-day economy of assistance for premature babies.

In our study, one of the most important elements for the aim of ensuring a longer duration of exposure of VLBWs to breast milk, which is that of the transition to the breast, was not analyzed. NICU infants face a unique set of challenges, and infants' progression to breastfeeding is often complicated by clinical criticalities, gastro-immaturity, and underlying medical comorbidities. Supportive practices such as oral therapy, skin-to-skin care and non-nourishing sucking are of great importance for the earlier initiation of breastfeeding, but also for the development and relationship of the dyad. Research<sup>49-51</sup> has shown that these practices support breast milk volumes and the baby's transition from enteral feed to breastfeeding, thus leading to higher breastfeeding rates. These are carried out systematically in our NICU and this could explain the improvement of data over the years, but they must be better accompanied by a total cultural change of pace in the monitoring and in the continuous improvement of care.

Maximum protection induced by breast milk is achieved when vulnerable infants receive high doses and long exposure to MOM<sup>31</sup>. Daily volumes of at least 500 ml before day 14 are indicated to be associated with significantly higher breastfeeding rates at discharge<sup>52</sup>. Breast milk volumes should be monitored to adapt clinical practice interventions. There are sporadic reports on this focus. One of the few examples is mPINC survey, a biennial census of all maternity care hospitals in the United States and territories to monitor practices and policies related to infant feeding.

The achievement of FEF occurred within 14 days for 65% of VLBWs with a median of 15 days. This is also important data to monitor, because the achievement of FEF translates into the suspension of parenteral nutrition and central venous access, with all that this entails in terms of complications related to both factors. We have not found comparable data on the average time to reach the FEF in the literature, and this element could also be a starting point for dedicated monitoring<sup>53,54</sup>. Two recent systematic reviews and meta-analyses<sup>55</sup> and other studies<sup>56</sup> show that the use of HM (MOM or DM) vs the formula leads to a better food tolerance, allows starting enteral feeding earlier, to increase milk volumes more rapidly with the faster achievement of FEF and allows reducing the use of parenteral nutrition and the related risks. Our NICU with attached HMB can be a confirmation<sup>57</sup>. In this regard, it should not be surprising that in our study no association was found between the use of MOM and the achievement of FEF or the length of hospitalization, which also reduced over the years, because no FM is used but only human milk since 2010.

In other NICUs, central catheters are removed when patients achieve an EF of 100 mL/kg/day<sup>58</sup>.

Even without a precise rule, but with an individualized approach, our cutoff varies between 80 and 100 ml/kg/day and we have a dedicated protocol on the progression of enteral feeding. There are some studies that have compared the effects between a slow increase in intake and a more aggressive progression of volumes.

The evidence-oriented literature is more likely to consider that enteral feeding, specifically early onset and faster enteral advancement, impacts on preterm infants' health during the first month of life, acting on the intestine promoting its maturation and a more beneficial microbiome composition, but also reducing inflammation and improving brain growth and neurodevelopment. Instead, delaying MEF and FEF may decrease the functional adaptation of the gastrointestinal tract and disrupt microbial colonization patterns<sup>59,60</sup>, promote inflammation<sup>17</sup> that increases the risk of comorbidities<sup>61,62</sup> and therapies to manage them, like steroid use, can impair linear growth<sup>63</sup>. Small and large randomized<sup>31-38</sup> trials seem to show that rapid enteral advancement and, even, early aggressive feeding regimens are feasible also in very small infants (750-1250 g), because they are not associated with increased risk of feed intolerance or NEC; maybe they do not reduce significantly mortality or morbidity during hospitalization but decreases the days to reach FEF and reduce the mean NICU stay duration. Also, in a review of 2019<sup>55</sup> a more sustained advancement appears to be safe and feasible in stable VLBW infants with birth weight >1000-1200 g, although it is believed that a large, randomized trial is needed to confirm the benefits.

In addition, the management of the advancement of enteral inputs also changes with respect to the country since, in many high-income countries, the conservative approach with a slower increase in volumes prevails, fearing that early FEF could increase the risk of hypoglycemia, food intolerance, gastro-esophageal reflux, ab ingestis and NEC in very preterm infants or VLBW<sup>38,39,64-66</sup>. However, in low- and middle-income countries with fewer resources for neonatal care, the practice tends to favor the early introduction and advancement of enteral feeds for stable infants<sup>67</sup>.

Others<sup>68</sup> indicate that slow advancement of enteral feed volumes compared to faster rates probably does not reduce the risk of NEC, death, or food intolerance in very preterm or VLBW infants, and instead may slightly increase the risk of invasive infection.

We also consider once again that the increase in the duration of parenteral nutrition is associated with infectious and metabolic complications that increase mortality and morbidity, prolong hospital stay and negatively affect growth and development<sup>69</sup>. For these reasons, some authors<sup>20</sup> believe that an early transition to full-volume enteral feeding should be seen as an ideal therapy to promote appropriate growth, body composition and development in preterm infants.

**Discharge** is a more studied topic. The data of breastfeeding at discharge are very unsatisfactory, with an average percentage of BF of 47.4%, if we consider the objectives indicated by national and transnational institutions. The numbers have grown over the years, except for 2020, the year of the pandemic. Data in line with those reported by VON<sup>70</sup>, where National data from more than 800 NICUs showed that provision of human milk at discharge among VLBW infants has increased from 44% in 2008 to 52% in 2017.

In Germany, 60.1% of patients were discharged with exclusive MOM feeds out of a sample of 368 premature babies<sup>21</sup>. This rate was higher than in the EPIPAGE-2 cohort study<sup>20</sup>, which reported 25% exclusive feeding and 47% of some MOM feeds at discharge in children under 32 weeks. In Greece, 48% of breastfeeding at discharge is reported<sup>24</sup>.

In the cohort from 11 countries in 19 European regions, 58.5% of preterm infants < 32 weeks received human milk at discharge<sup>20</sup> with important regional differences in breastfeeding rates and significant variations reaching from 36% to 80%. Rates ranging from 49% to 87% among NICUs have been reported in the United States<sup>28</sup>.

In a multicentric study<sup>71</sup> 45% of infants <1500 g birth weight and 23% of infants >2500 g did not receive MOM at discharge in Italy. In a more recent report<sup>72</sup> of a single NICU, the 66% of preterm infants received any breastfeeding at discharge of which 27% were exclusively breastfed. A more up-to-date Italian survey would be desirable.

Very few reports have evaluated breastfeeding in the months following discharge.

Few Portuguese studies<sup>73</sup> have reported a low and variable (1.0% to 27.0%) prevalence of exclusive breastfeeding at 6 months and any breast milk at 12 months (8.0% to 12.0%). In another Greek study<sup>74</sup>, 58.1% were exclusively breastfed during the first month, with a gradual decrease to 36.9% to the third month of life and 19.4% to the sixth. The prevalence of breastfed infants reached 14.7% and 7.5% at the ages of twelve and eighteen months, respectively.

Young **maternal age** is indicated in some studies as a risk factor for NMOM feeding at discharge. Every year of MA was associated with a 1.24-fold increase in direct breastfeeding at hospital discharge, or infants with mothers younger than 25 years were 30% less likely to be breastfed than infants with older mothers<sup>75</sup>. Mothers aged <25 years ceased breastfeeding more often before discharge and before six months of age than mothers over the age of 25<sup>76</sup>.

In our study, feeding with HM at discharge was 54.5% for mothers aged 36 to 40 years and 21.4% for those aged 21 to 30 years with the only statistically significant difference (p value<0.005), and maternal age was a factor that significantly influenced breastfeeding at discharge. Thus, younger mothers represent a category to be supported more.

Of the 13 GA≤25 weeks infants, 77% received MOM in the first few weeks and 61.5% received at discharge. For the 30 infants born of GA ≥30 weeks, 58% received MOM in NICU and 35% at discharge. Statistically significant association was found between **gestational age** and MOM feeding at discharge. In our previous report<sup>77</sup>, mothers of preterm babies of GA ≤29-week were more likely to produce breast milk.

Probably, the care dedicated to the mothers of VLBW is more effective both for the predisposition of mothers who recognize, in the extraction of milk, the only act they can make available for the survival and health of their children, and for the health personnel, who welcome a newborn who will undergo a long hospitalization. The data is interesting, considering that the milk produced by the mothers of VLBWs has a specific composition tailored to this fragile category of premature babies<sup>77,78</sup>. But it is objectively paradoxical that babies born at a higher gestational age and who are therefore more able, have been fed less with MOM.

37.5% of VLBW premature babies are **twins**.

Of the 37 twins, 50% received MOM in NICU compared to 66.7% of those born from single pregnancies with unexpectedly higher rates of MOM in discharge for twins (48.3% vs 43.1%). This confirm a trend of our NICU<sup>79</sup>, and comparing it with the few other reports available, we can state that multiples were not at higher risk of NMOM feed than singletons in some cases. But the data on multiple births are controversial, since some studies show an association with exclusive breastfeeding<sup>80</sup>, while others<sup>75,81,82</sup> show an association with NMOM feeds or discontinuation of breastfeeding before six months of age. Further studies to clarify this point would be needed.

The **type of delivery**, although with clearly prevalent CS, did not affect the type of feeding either during hospitalization or at discharge. Weight growth is one of the most important factors in the management of VLBWs for their implications on the outcome. Average daily weight gain has improved significantly and this is an encouraging achieved goal.

There is a debate about the comparison between breast milk and **donated milk**, and their impact on VLBW growth. In our report there is no statistical significance in monitoring weight gain with respect to the type of diet (in our NICU, only human milk is used for VLBW), namely there was no significant difference in the daily weight trend between those fed with DM and those fed with their mother's milk, both fortified at the right time. Santiago<sup>83</sup> et al. conducted a review with heterogeneous results regarding weight gain and linear growth in infants' fed with human milk, fortified human milk or preterm formula<sup>76</sup>. The data in the literature are controversial but it is shown that the presence of HMBs and/or the use of DM in NICU are associated with an increased incidence of breastfeeding both during hospitalization and at discharge<sup>84</sup>. And this is also our experience.

An international survey<sup>85</sup> on differences in feeding practices found that most NICUs with access to DM started enteral feeding earlier and progressed more rapidly. Units without access to DM often delayed the introduction of enteral feeds until MOM was available<sup>86</sup>.

We believe that providing DM to vulnerable infants who do not have MOM can save lives and raise awareness of the value of breastfeeding and human milk in NICU and in the community.

Few modifiable factors were included in our study. However, it should be remembered that in the NICU, the most significant results are obtained when the staff is trained to promote breastfeeding and donation<sup>87</sup>. The role of health professionals in a multidisciplinary framework is fundamental in supporting mothers in breastfeeding in neonatal intensive care, in accompanying early and frequent expression of milk, in promoting skin to skin and direct breast attack when conditions allow it. They should be prepared to identify and counteract psychological, physical, social and cultural barriers to successful milk extraction and to breastfeeding. It is a question of priorities that should be established and integrated into the cultural background and in daily actions.

#### 4. Conclusions and relevance

VLBWs pose a significant nutritional challenge. Feeding rates with MOM during hospitalization and at discharge have improved increasing by 13% circa in recent years, a common trend to other countries, but these levels are still very far from those indicated by the WHO and the national and international bodies and agency. The year of the pandemic was devastating also for our NICU, with a marked reduction in the use of MOM and in breastfeeding. The timing of the start of EF resulted the most important predictive element of MOM feeding, which, over the years, is back to 72 hours of life. ELBW infants' mothers extract more milk, and young mothers feed less their preterm babies with MOM. No significant differences have been registered in the trend of the VLBW babies' weight between those fed with MOM and those fed with DM. The literature lacks systematic and coherent data, which are useful for a necessary monitoring of feeding in NICU and in the months after discharge, if you consider the quantitative and qualitative impact of the use of mother's milk on development and outcome, therefore on the future of this vulnerable category of children.

#### Abbreviations

MOM	Mother's Own Milk
EMOM	Exclusive Mother's Own Milk
MMOM	Mixed Mother's Own Milk
NMOM	No Mother's Own Milk
HM	Human Milk
DM	Donor Milk
FM	Formula Milk
HMB	Human Milk Bank
BF	Breastfeeding
EBF	Exclusive Breastfeeding
EF	Enteral Feeding
MEF	Minimal Enteral Feeding
FEF	Full Enteral Feeding
VLBW	Very Low Birth Weight

ELBW  
NEC

Extremely Low Birth Weight  
Necrotizing Enterocolitis

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