



## **Breastfeeding in premature infants: in-hospital clinical management**

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### **Abstract**

**Objective:** To describe the importance of breastfeeding and its promotion in the in-hospital clinical management of premature newborns.

**Source of data:** The authors made an extensive literature review on the topic, including technical books, theses, publications of national and international organizations, and search on MEDLINE database (1990 to 2003), using the following key words and boolean operators: "breastfeeding AND low birth weight" and "breastfeeding AND preterm infant". Some significant references cited in the reviewed publications were used as well.

**Summary of the findings:** After this review we conclude that many aspects make the breast milk particularly suitable to the premature newborn feeding. Despite being highly desirable, little success in breastfeeding preterm infants is generally observed, particularly in special care neonatal units, although there are evidences suggesting that a highly supportive hospital environment can make it possible to breastfeed these infants.

**Conclusions:** Although breastfeeding premature infants represents a challenge, it is feasible if appropriate help and support are provided. Mothers of premature infants need information and support to make informed decisions about their infants feeding.

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Breastfeeding is the safest and most natural form of infant feeding, and it should be exclusive up to the sixth month. After that, complementary feeding should be implemented, but breastfeeding can be maintained up to the second year of life or longer.<sup>1</sup> Human milk provides a unique combination of proteins, lipids, carbohydrates, minerals, vitamins, enzymes and living cells, in addition to offering nutritional, immunological, psychological and economic benefits.<sup>2-7</sup> These qualities have great importance when it comes to preterm

newborns (PTNB), due to their greater vulnerability.<sup>8</sup>

The appropriate clinical management of lactation has been described to facilitate the successful breastfeeding of full-term newborns.<sup>9</sup> The medical literature also provides evidence that mothers of PTNB infants should have access to breastfeeding support, in order to maintain a sufficient milk production; however, practical aspects regarding the promotion of human milk feeding still have not been settled into the routine care of preterm infants in most neonatal units.<sup>8,10</sup>

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### Major advantages of breastfeeding for preterm infants

The recommendation of breastfeeding for PTNB infants has been advocated based on the immunological properties of human milk, on its role in gastrointestinal maturation, on the establishment of mother and infant bonding and on the improved neurobehavioral performance of breastfed infants.<sup>11-13</sup> During breastfeeding, suck-swallow coordination of preterm infants is enhanced. It has been confirmed that the levels of transcutaneous oxygen partial pressure, oxygen saturation, and body temperature are higher than those obtained during bottle-feeding,<sup>14-17</sup> thus corroborating that breastfeeding has far more physiological advantages. Very likely, diseases of prematurity result from an imbalance between antioxidant defenses and exposure to free radicals released after hypoxia or reperfusion injury, which, in excess, would incur risks of necrotizing enterocolitis, bronchopulmonary dysplasia, intraventricular hemorrhage, and retinopathy of prematurity. Since PTNB infants do not seem to have a well developed protection against oxidative stress, the use of human milk would be an advantage, as it offers better antioxidant protection than artificial milk.<sup>18</sup> The incidence of any infection, including necrotizing enterocolitis, sepsis and meningitis, is significantly lower in very low birthweight (VLBW) infants fed human milk, when compared to those fed only artificial milk<sup>19-21</sup>.

When the mother stays together with the PTNB infant throughout his/her hospital stay, there is maternal production of antibodies against nosocomial microorganisms, which is important to the prevention of infections in hospitalized newborns.<sup>22</sup> A significant reduction in the incidence of severe infections was observed among patients submitted to kangaroo mother care (the newborn is kept in a vertical position, lying prone, and secured snugly against the mother's body, allowing for early and closer contact between mother and infant),<sup>23</sup> when compared to those patients treated with the traditional method.<sup>24,25</sup>

Breastmilk protects preterm infants with family history of atopy from allergies, especially from the incidence of eczema. This was observed at 18 months, when infants who received artificial milk showed a higher risk of developing this kind of reaction, compared to infants who received banked human milk.<sup>26</sup>

Omega 3 fatty acids are essential to the normal development of the retina, especially in VLBW infants.<sup>27,28</sup> Thus, these lipids, along with other antioxidant substances, such as vitamin E, betacarotene and taurine, may explain the protection provided by human milk against retinopathy of prematurity. It is common knowledge that the incidence and severity of retinopathy of prematurity are significantly low in those who were exclusively breastfed or whose diet consisted of at least 80% of human milk.<sup>29</sup> Moreover, cognitive development in breastfed preterm infants is enhanced.<sup>30-32</sup> There also exists epidemiological evidence that breastfeeding is related to lower rates of hospital readmission among PTNB infants, even after

complementary feeding. Therefore, breastfeeding, even if partial, should be encouraged in this population.<sup>13,22,33</sup>

### The importance of breastfeeding support

Albeit desirable, little success in breastfeeding has been observed among mothers of preterm newborns,<sup>34</sup> because there are still many hindrances to breastfeeding,<sup>35</sup> especially in neonatal intensive care units.<sup>36</sup> Quite frequently, weaning occurs long before the discharge of the PTNB infant from the neonatal unit.<sup>37</sup>

Breastfeeding preterm infants surely is a challenge. PTNB infants show physiological and neurological immaturity, muscle hypotonia and hyperreactivity to environmental stimuli, being alert for very short periods.<sup>38</sup> Despite the inappropriate suck/swallow/breathe coordination,<sup>39</sup> a PTNB infant is able to breastfeed, provided that adequate help and support is offered.<sup>40</sup> Neonatologists need not only be convinced of the multiple advantages of breastfeeding and of the possibility to feed a PTNB infant with human milk, but they also should integrate breastfeeding management and support with therapeutic planning in these patients.<sup>41</sup>

During hospitalization in the neonatal unit, many mothers realize that breastfeeding is the only thing they can do to help their babies to recover. However, very few mothers are able to start and maintain an appropriate breastmilk production without qualified help and family support.<sup>42</sup> Support to mothers is fundamental for initiation of breastfeeding. Starting with labor, the work of doulas – community women who offer physical and emotional support to mothers – has been related to continuance of breastfeeding.<sup>43</sup> Similar experiences have been used in neonatal intensive care units, where doulas offer breastfeeding assistance and support to mothers with social difficulties. This intervention is believed to extend the duration of breastfeeding among women whose newborn infants have been admitted to neonatal intensive care units.<sup>44</sup>

Families can have considerable influence on the breastfeeding of LBW infants. One should recall that they must be seen as a constituent part of the breastfeeding experience and as important to the support of the mother-infant dyad. Health professionals need to instruct families properly in order for them to help mothers take an informed and conscious decision about the feeding of their infants.<sup>45</sup> Among African-American women, the maternal grandmother's opinion is strongly associated with the mother's intention to breastfeed.<sup>46</sup> A prospective Australian study involving 1,059 women confirms that puerperal mothers need their mother's approval and support in order to continue breastfeeding.<sup>47</sup> Men usually do not realize how important their support is for a successful breastfeeding. However, a study demonstrated that mothers of VLBW infants who were more often encouraged by their husbands would continue to express breastmilk in order to maintain breastfeeding during the stay of the infant in the neonatal unit.<sup>48</sup> A study carried

out in Honduras with mothers of newborn infants weighing between 1,500 and 2,500g showed that there may be a negative influence of parents and friends on breastfeeding, but that nursing mothers who are persistent and learn from the guidance provided by health professionals can overcome these difficulties and be able to breastfeed.<sup>49</sup>

While most of the socioeconomic aspects that affect breastfeeding cannot be changed, support to mothers can be encouraged and promoted, resulting in an increase in breastfeeding rates.<sup>50</sup>

### **Milk expression**

The mothers of newborn infants admitted to neonatal units need to be encouraged and guided to start milk expression as early as possible in order to stimulate lactation. Milk insufficiency is determined by a delay in milk expression and the inhibition of milk letdown due to anxiety and concern about the newborn infant.<sup>51</sup> It is important that milk expression be initiated immediately after delivery, if possible, because early stimulation of the breasts, especially before 48 hours, seems to be essential to an appropriate milk production in subsequent weeks.<sup>52</sup>

Milk can be expressed either manually or mechanically,<sup>53,54</sup> but its expression should always be preceded by careful handwashing, selection of a calm place and gentle massage on all quadrants of the breast, which is fundamental to milk letdown.<sup>55</sup> Massage, with stimulation of the breast tissue and nipples, has an additional effect on the increase of milk production.<sup>51</sup>

Manual milk expression, which can be easily mastered, should be demonstrated to mothers in the postnatal period as an important aspect regarding self-care with puerperal breasts.<sup>56,57</sup> Mechanical milk expression is another alternative to obtaining breastmilk, but it is important to consider efficiency, availability, cost and potential nipple trauma associated with pumps before recommending them.<sup>55</sup> Due to technological advance, milk pumps are now produced with malleable material and a more modern layout, facilitating their use and decreasing the risks of nipple injury.<sup>58</sup>

Milk pumps can be hand-operated or electrical. Manual and battery-operated pumps are inappropriate for prolonged breastfeeding.<sup>10</sup> Modern electrical pumps are more efficient and, if adjusted to express milk from both breasts simultaneously, they allow obtaining the same volume of milk in half the time, as they increase prolactin secretion.<sup>55,58</sup> When milk expression is necessary for a long time period, the difference in time efficiency can influence the mother's intention to continue breastfeeding.<sup>59</sup> The simultaneous expression of milk from both breasts is more effective in keeping its production, in addition to increasing its lipid content.<sup>51</sup> Therefore, electrical pumps that allow milk expression from both breasts should be preferred, especially if the PTNB infant weighs less than 1,500 g, is unable to suck at the breast for at least two weeks, or is a twin.<sup>54</sup>

A breastmilk production of 500 ml/day or 3,500 ml/week is the minimum necessary to meet the nutritional

requirements of preterm newborns after they are discharged from the neonatal unit.<sup>60</sup> There is a huge variation in the volume of breastmilk produced by the mothers of preterm infants who require artificial milk expression while their infants cannot suck directly at the breast.<sup>59,61</sup> The frequency of milk expression in these women should be similar to the number of daily breastfeedings of a full-term infant (around eight to 10 times), with the aim of stimulating prolactin secretion and allowing for a longer and sufficient breastmilk production. Milk expression in the first days after delivery should last between 10 and 15 minutes and, after milk letdown, it should continue up to two minutes after the extraction of the last drops of milk, which may determine a total expression duration of 20 to 30 minutes.<sup>10</sup>

Milk production is directly associated with the frequency of expression. Among mothers of nonbreastfed preterm infants who express milk four or more times a day, the volume of milk obtained is significantly larger than those who express milk three times or less a day.<sup>61</sup> A significantly positive correlation has been described between milk expression performed at least six times a day and higher milk production in the second week after preterm birth. Under these circumstances, the puerperal mother will certainly manage to maintain the volume of human milk necessary to feed her infant at hospital discharge.<sup>59</sup>

An increase in the milk volume produced<sup>59</sup> or a more stable milk production<sup>62</sup> has been observed among mothers who use the kangaroo mother care, comparatively to mothers whose PTNB infants were submitted to conventional treatment in incubators. The application of this technique is a way to humanize and improve perinatal care and promote breastfeeding without affecting the survival, growth and development of preterm infants.<sup>63</sup> Therefore, mothers of PTNB should be encouraged to express breastmilk, use the kangaroo care method as often as possible and have their milk production assessed in the second week after delivery, so that the necessity of an intervention to increase milk volume can be determined.<sup>59</sup>

For women whose infants cannot suck directly at the breast, in addition to milk expression, the use of galactogogues should be considered, as these medications stimulate prolactin secretion and, consequently, increase the milk flow. Several substances have been described as galactogogues, but metoclopramide has been the most widely investigated.<sup>64</sup> This drug antagonizes dopamine secretion into the central nervous system and promotes lactation. The use of 10 mg of metoclopramide, three times a day, for 7 to 14 days, has been effective and safe for continuance of breastfeeding in mothers of PTNB infants.<sup>64,65</sup> Although metoclopramide reaches high concentrations in breastmilk in relation to its serum level,<sup>66,67</sup> this drug is compatible with breastfeeding, provided that it is not used for long time periods.<sup>68</sup> Side effects include extrapyramidal reactions, dizziness, nausea and depression. In case of depressive symptoms, the treatment should be discontinued.<sup>65</sup> Domperidone, a prokinetic drug, also increases lactation, and is detected

in small amounts in breastmilk;<sup>69</sup> however, a recent report of the U.S. Food and Drug Administration (FDA) warned against the use of domperidone during breastfeeding.<sup>70</sup>

In nursing mothers whose milk flow has decreased substantially, relactation, an efficient technique for restoring milk production, is an alternative. The expressed milk should be offered via supplementer, thus avoiding the use of artificial teats. There are industrialized supplementers, but the easiest way to increase the intake of calories and to encourage the newborn infant to nurse is by offering the milk in a cup or syringe with a coupled nasogastric tube, whose other end is fixed onto the breast, close to the nipple, using Scotch tape. Thus, when sucking, the PTNB infant grasps the areola and the tube simultaneously, sucking milk from the breast and from the syringe or cup.<sup>71</sup>

### **Storage of expressed human milk**

Proper storage and handling of expressed breastmilk are essential to vulnerable hospitalized PTNB infants. Plastic containers (polypropylene and polycarbonate) or glass containers are the most widely used for breastmilk storage, with a small loss of fat and cellular components. Polyethylene containers, in their turn, pose a higher risk of contamination, as they are easily broken, in addition to presenting significant lipid loss. Obviously, raw and unprocessed breastmilk, from the mother to her infant, should be consumed immediately after collection, so that the singular properties of breastmilk remain unchanged and bacterial proliferation is prevented.<sup>72</sup>

Both refrigeration and freezing can be used for the preservation of expressed milk for a short period of time: no longer than 24 hours and 15 days, respectively.<sup>73</sup> In case of a donor's milk, the milk must be pasteurized and submitted to bacteriological control.<sup>74</sup> Pasteurization is a treatment applied to human milk with the aim of thermally inactivating 100% of the pathogenic bacteria and 90% of their saprophytic flora, by heating at 62.5 °C for 30 minutes, followed by cooling.<sup>73</sup>

The biological benefits of breastmilk make it an excellent food for PTNB infants, despite the fact that occasional nutrient loss during collection,<sup>75</sup> processing,<sup>76,77</sup> storage<sup>78,79</sup> and the method used to offer human milk<sup>11,80</sup> to patients in the neonatal units may be held responsible for the slower development of newborns, compared to those who are fed artificial milk.<sup>81</sup> While neonatal development is better for formula-fed PTNB infants, this does not apply to weight, height, head circumference and skinfold measured at around nine months and at eight years of life, which were similar, regardless of the diet used (breastmilk or only artificial milk).<sup>82</sup>

### **Special considerations for human milk feeding of preterm infants**

Breastmilk from the mother is the food of choice for PTNB infants. The milk produced by the mother of a PTNB

infant in the first four weeks after delivery contains a higher concentration of nitrogen, proteins with immunological functions, total lipids, medium-chain fatty acids, vitamins A, D and E, calcium, sodium and energy than that produced by mothers of a full-term infant.<sup>83</sup> If the infant cannot suck directly at the breast, he/she must receive the expressed milk.<sup>39</sup> A strategy that results in increased weight gain among PTNB infants is the offer of hindmilk, which contains up to three times more fat than foremilk.<sup>84</sup> The use of hindmilk mechanically expressed from the mother of LBW infants treated at a neonatal unit of a developing country is related to an average increase in weight of 18.8 g a day.<sup>85</sup> If breastmilk is not available from the mother, the alternative is to use banked human milk, which preserves many of the protective factors.<sup>75,86</sup> Although this pooled banked human milk is a safe and feasible alternative for PTNB infants,<sup>90</sup> it may be nutritionally inappropriate for preterm infants.<sup>82,88</sup>

Whenever possible, this milk should be supplemented with nutrients obtained from human milk itself.<sup>89</sup> Industrialized additives, derived from cow's milk, are also available and are recommended by some authors in order to meet the nutritional requirements of infants.<sup>90,91</sup> There are a wide variety of human milk additives, most of which are prepared with proteins, carbohydrates, calcium, phosphorus, magnesium and sodium, also including zinc, copper and vitamins.<sup>92</sup> The addition of these cow-derived nutrients to human milk has allowed VLBW infants proper growth rates,<sup>89,93</sup> without affecting gastric emptying and food tolerance.<sup>94</sup> Nevertheless, the handling of breastmilk is not risk-free. The addition of exogenous substances may alter osmolarity and interfere with the intrinsic defense properties of human milk.<sup>8,92,95</sup> On top of that, in developing countries, additives are not always available for all PTNB infants, and therefore it is necessary to identify which of them could actually benefit from this nutritional supplementation.<sup>96</sup>

Exposure of breastfed infants to pacifiers and artificial teats in the neonatal period has not been recommended due to the risk of their interference with breastfeeding.<sup>97</sup> It is perfectly known that the risk of weaning is greater among those infants exposed to artificial teats,<sup>98</sup> as in these cases, the frequency and duration of breastfeedings are reduced, and "nipple confusion" is suspected, especially among women with breastfeeding difficulties.<sup>99</sup> However, a study revealed that the use of pacifiers did not affect breastfeeding in preterm infants younger than 34 weeks.<sup>100</sup>

Since sucking on bottle nipples can affect the ability of preterm infants to nurse at the breast, they should be avoided, and alternative methods for complementary milk supply are preferred.<sup>101</sup> The use of little cups is described as a safe, simple, practical and inexpensive way to feed PTNB and LBW infants until they can obtain all their energy requirements directly from the breast.<sup>102</sup> When suck-swallow coordination has been achieved, the supply of milk via little cups can be used to replace the nasogastric tube in infants weighing up to 1,300 g.<sup>103</sup> Cup feeding is associated with a significant increase in exclusive

breastfeeding in preterm infants at hospital discharge; however, the length of hospital stay of these neonates is longer.<sup>100</sup> A study conducted in Ribeirão Preto, state of São Paulo, Brazil, showed that cup-fed infants had a significantly lower incidence of reduced oxygen saturation ( $\text{SaO}_2 \leq 85\%$ ) during feeding than bottle-fed PTNB infants. A higher prevalence of breastfeeding at three months of life in the group that was fed immediately after hospital discharge also was observed. No crises of apnea or bronchoaspiration were described, and weight gain was similar to that of bottle-fed infants.<sup>104</sup> Although PTNB were physiologically stable during cup feeding, the efficiency of this method in developing the tongue and jaw movements necessary for breastfeeding has been argued. One should also recall that the risk of actual milk intake might be lower than required, due to losses caused by spilling.<sup>105</sup>

Another alternative for the feeding of PTNB infants consists of an adaptation of the previously described re-lactation technique, in which the supply of expressed milk occurs via a tube connected to a syringe, with the other end connected to the nipple, to be introduced into the infant's mouth during the feeding. This way, there is some transition from the nasogastric tube to the breast, without the use of a cup, and the mother herself feeds the infant.<sup>53,106</sup>

### **Breastfeeding in the neonatal unit**

In the literature, no agreement exists about the appropriate time to initiate breastfeeding in preterm infants. The commonly used conventional indicators are physiological stability, weight greater than or equal to 1,500 g, gestational age greater than or equal to 34 weeks and ability to ingest the whole volume of milk indicated in the bottle.<sup>8,42,107</sup> However, by choosing weight, gestational age or ability to suck at the bottle, there is a risk of delaying suction directly at the breast.<sup>60</sup> Ideally, the following aspects should also be taken into consideration: behavioral criteria, how to suck at the nasogastric tube, showing rooting reflex during skin-to-skin contact, and staying alert, considering the observations of mothers and nurses.<sup>8</sup>

It has been described that oral stimulation of PTNB newborns may accelerate the acquisition of sucking ability, facilitating the early acceptance of larger volumes of milk given orally.<sup>108</sup> Also, the implementation of oral feeding around 31 weeks of postconceptional gestational age, that is, before the time usually observed in most neonatal units, seems to reduce the time necessary to obtain all energy requirements without a nasogastric tube.<sup>109</sup> A reduction in time of five days for healthy preterm infants to totally accept the oral supply of milk, with satisfactory weight gain, can be obtained through a partially free on demand regimen, based on the newborn's behavioral status, estimated every three hours. If the newborn is alert or drowsy, feeding occurs orally. If the infant is asleep, he/she is allowed to sleep for another half hour

before the next assessment. If the infant is slightly or sound asleep, milk is supplied by a gastric tube.<sup>110</sup> It also has been described that PTNB infants can be fed on demand, reaching the appropriate ingestion of milk volume in a shorter time than those fed at fixed schedules,<sup>111</sup> but it is necessary to carefully follow up the weight gain of these patients in order to guarantee that they have proper nutrition.<sup>106</sup>

Unfortunately, the transition from tube to oral feeding is more based on the routines of various services than on the observation and knowledge about the development of preterm infants.<sup>10</sup> In-hospital breastfeeding sessions aim at establishing the proper positioning of the PTNB infant at the breast and at facilitating the monitoring of breastfeeding responses. Feedings at an empty breast can be used, allowing for sucking experience without any interference in nutrition, complementing the feeding with milk expressed with a nasogastric tube.<sup>112</sup>

Proper positioning is important to the breastfeeding technique. Some positions are more recommended for preterm infants, as they allow the mother to hold and control the head and neck of the infant, which results in proper latch-on, with effective milk transfer, without interfering in the permeability of the upper airways. The first position (known as football or clutch hold) is that in which the mother is sitting and holds the infant's body against her forearm, holding the infant's head while the legs are tucked behind her, as if she were holding a football. The second position is a variation of the conventional one, known as transverse or cross-cradle hold, that is, while the mother is sitting, the newborn is held against her body, and she holds the infant in the arm opposite the breast from which he/she will latch onto, also supporting the infant's head in her hands. The use of pillows to raise the infant up to the right level and support the arms is indicated in both cases.<sup>10,60</sup> The horse riding position, in which the infant sits on the mother's leg with his/her body facing hers, allowing the head to be higher than breast level, also is recommended.<sup>106</sup>

The temporary use of flexible nipple shields is contested by some authors, but it has been indicated by others as a way to facilitate breastfeeding in some preterm infants.<sup>113,114</sup> Meier et al.<sup>114</sup> described that extremely thin silicone shields apparently increase the milk transfer from the breast to the PTNB infant, reducing the need of complementary feeding without interfering in the total duration of breastfeeding.

To assess the amount of milk ingested in each breastfeeding, it may be useful to weigh the PTNB infant before and after breastfeeding, considering that the difference in weight would be equal to the volume of milk ingested by the infant. The use of electronic scales has been recommended to quantify the intake of breastmilk and adjust breastfeeding management in these infants.<sup>115-117</sup> Conventional scales are not recommended due to their lack of accuracy.<sup>118,119</sup> Moreover, mother's anxiety regarding infant weight measurement is also a concern, but it has been recently described that the development of confidence by the mother in her ability to care for and

breastfeed her preterm infant occurs regardless of weight measurements before and after breastfeedings during hospitalization in the neonatal unit.<sup>120</sup>

### **Breastfeeding management experiences in PTNB infants in the literature**

When we search the literature for studies on natural breastfeeding of preterm infants, we note that many of the scientific articles that have been published do not clearly define breastfeeding at hospital discharge and do not specifically describe the available breastfeeding promotion programs.<sup>121</sup> Subsequently, we describe international and national studies conducted in neonatal units where some breastfeeding promotion policy is employed, showing that the breastfeeding of PTNB is feasible. However, this is not the reality in most neonatal intensive care units around the world, since hospitalized PTNB infants still are deprived of the presence of their mother and of breastfeeding.<sup>122</sup>

In Europe, studies have been carried out in Norway, Finland, Switzerland and Sweden. In Norway, a comparative study of 100 preterm infants and 108 full-term infants born in a maternity ward where the mother was encouraged to continue breastfeeding and to establish a bonding with her preterm infant revealed that 96.3% of full-term babies and 96% of PTNB infants were discharged from hospital receiving breastmilk, but those women who gave birth to full-term babies showed a higher rate of exclusive breastfeeding: 88.9% *versus* 55%.<sup>123</sup> In Finland, the frequency of breastfeeding among 131 mothers of infants with birthweight less than or equal to 2,500 g was of 91% at a neonatal unit that offered lactation consultancy for teaching breastfeeding practices to mothers and hospital staff. Next to this unit, there was a comfortable, especially designed place where mothers were encouraged to express breastmilk and breastfeed as soon as the infant's clinical conditions allowed so.<sup>124</sup> In Switzerland, a study involving 327 infants admitted to a neonatal intensive care unit, which often treats a small number of VLBW infants (10.8%), showed a breastfeeding rate of 75%. Since there was no hospital accommodation for the mothers, they were encouraged to visit their children every day to bring them the expressed milk and receive instructions about breastfeeding. Breastfeedings were initiated as soon as the infant's clinical conditions stabilized.<sup>125</sup> And in Sweden, a study evaluated 71 PTNB infants with gestational age lower than or equal to 35 weeks, admitted to a neonatal unit of a teaching hospital, where early skin-to-skin contact was encouraged, mothers were allowed to stay with their children, and the use of artificial teats was avoided, and where infants were cup-fed. The rate of breastfeeding was of 94.4%, where 80.3% corresponded to exclusive breastfeeding.<sup>126</sup> In another Swedish neonatal unit, where natural breastfeeding was the rule, 93% of 70 LBW infants were discharged from hospital receiving breastmilk. In this group, 10% had a birthweight lower than 1,500 g.<sup>127</sup>

In the USA, there are few studies with representative samples of the PTNB population admitted to neonatal

units. Most of them select the sample based on the mother's decision to breastfeed. This is a result of the low breastfeeding rates observed in U.S. hospitals: 52.2% in 1990 and 59.7% in 1995,<sup>128</sup> far from the aim of the U.S. Health Department, which intended to reach 75% of breastfeeding in the immediate puerperium.<sup>129</sup> In New Haven, Connecticut, of 72 mothers of PTNB infants with birthweight less than or equal to 2,000 g who wanted to breastfeed, continuance of breastfeeding amounted to 75%, in a hospital that provided breastfeeding support, but whose routines have not been described.<sup>130</sup> In San Francisco, California, of 42 mothers of preterm infants weighing less than 1,250 g who planned to breastfeed, only 44% continued to breastfeed and intended to continue breastfeeding after hospital discharge.<sup>37</sup> Furman et al.<sup>48</sup> studied the whole population of preterm infants admitted to an NICU, in Cleveland, Ohio, where there was breastfeeding incentive and mothers were encouraged to initiate milk expression early on, and found that of 82 mothers of VLBW infants, 49% continued to breastfeed up to hospital discharge and 21% made the transition to breastfeeding. Also in the USA, Hill et al.<sup>121</sup> assessed the type of feeding of 110 infants weighing between 1,500 and 2,500 g, among whom 90 were preterm, and showed that 54% of LBW infants were on exclusive breastfeeding at hospital discharge. Another U.S. neonatal intensive care unit, which provides well-organized breastfeeding support, and where the expression of breastmilk, to be offered via gastric tubes, was encouraged, and mothers were assisted during breastfeeding and followed up after hospital discharge, revealed that out of 132 ill infants, 56.8% of whom were PTNB, 71.2% were on breastfeeding at hospital discharge.<sup>131</sup>

In Canada, among 55 mothers of 62 LBW infants, 58% were breastfeeding when discharged from hospital. This hospital encouraged breastfeeding on a routine basis. Puerperal mothers were educated and watched videos in order to learn how to express and store breastmilk, in addition to having a breastfeeding room and being allowed to stay with the infants (rooming-in).<sup>132</sup>

A multicenter study carried out in Ethiopia, Indonesia and Mexico assessed 149 infants, weighing between 1,000 g and 1,999 g, submitted to kangaroo mother care, and who started to breastfeed very early on, and described exclusive breastfeeding rates of 98, 83 and 80%, respectively, with an overall rate of 88%.<sup>133</sup>

In Brazil, Xavier et al.<sup>134</sup> obtained a breastfeeding rate of 86.5% at hospital discharge, when studying a population of 222 LBW infants, of whom 50.5% were preterm, in a nursery of a teaching hospital of Ribeirão Preto, where the mother's own milk was the food of choice for the newborn. The hospital had a human milk bank and provided meetings for the mothers for breastfeeding promotion. In Campinas, the assessment of newborns with a long hospital stay at a neonatal unit where preterm births amounted to 43.9%, demonstrated 88.9% of breastfeeding at hospital discharge. The hospital employed breastfeeding promotion, characterized by recommending

early milk expression, stimulating the mother to care for her hospitalized infant, and facilitating her readmission for breastfeeding.<sup>135</sup> And finally, a prospective study conducted in a Baby-Friendly Hospital in Joinville, state of Santa Catarina, assessed 244 PTNB infants and found a frequency of breastfeeding at discharge from the NICU of 94.6%. The rates of exclusive, non-exclusive breastfeeding and absence of breastfeeding were respectively 84.4, 10.2 and 5.4%.<sup>136</sup>

### Final remarks

To improve the feeding and nutrition of PTNB infants, the care provided by hospitals should go through some changes. It is essential that medicine practiced at neonatal units not be based only on high technology, but also consider the humanization of care. Neonatal care should be provided by qualified professionals, in a proper hospital environment, providing individualized care, and allowing more interaction between parents and infants.<sup>106</sup> Parents of preterm infants should be regarded as collaborators in infant care and their presence should be indispensable for healthy psychomotor development and bonding.<sup>137</sup>

To have success in the breastfeeding of preterm infants, perinatal care should be optimized, and include accurate and individualized assessment of mothers and infants, guaranteeing unconditional support for the establishment and continuance of breastfeeding.<sup>138</sup> The proper follow-up of PTNB after hospital discharge also is fundamental for continuance of breastfeeding at home.<sup>63</sup> Mothers require special attention, especially in the first week after hospital discharge, and regular assessment of the infant's growth and development are essential.<sup>57</sup>

In order to make breastfeeding promotion, protection and support feasible, health professionals should be prepared to incorporate the clinical management of breastfeeding into the NICU routine. The team should feel motivated and able to convey consistent information about breastfeeding to the mother. This requires training in health education and a total change in the habits of clinical management. Furthermore, for women who give birth to PTNB infants and who need to establish a mother-infant bonding that is different from that which is idealized, breastfeeding can be a practical and positive way to deal with preterm birth.

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