# The challenges of feeding a preterm baby

Significant developments occur daily for both mother and baby during pregnancy and therefore when a pregnancy is cut short major challenges arise. Compelling evidence supports the need for every infant to benefit from mothers' breast milk. This is especially true for a preterm infant or extremely low birthweight baby, but the combination of the mother's underdeveloped breast tissue and an infant with a weak sucking reflex makes it extremely difficult to initiate feeding. This article looks into these challenges, supports the role of breast milk for a preterm and discusses the latest developments and technological advancements being made to support this vulnerable pair.

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### Key points

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- The breast prepares for breastfeeding throughout pregnancy – the breast tissue of mothers of premature babies is not fully formed or functioning properly.
- 2. Preterm mothers face major challenges when attempting to initiate and sustain breastfeeding.
- Breast milk can play a vital role in promoting the health of premature and term babies, both immediately after birth and in the long term.
- 4. Preterm newborn infants suck in rapid and irregular patterns with pauses.
- Improved understanding of the sucking pattern of newborn and premature infants may enable better support for mothers of preterm infants to initiate and sustain successful lactation.

### The benefits of breast milk

Breast milk is a complete food source, containing all the nutrients that a term baby needs, including the hormonal and immunological components which cannot be found in artificial formula milk<sup>1</sup>. Its nutritional properties are tailored to meet the developmental needs of a term baby, and it plays an invaluable role in providing innate immunological protection against pathogenic micro-organisms<sup>2</sup>.

Despite this fact being widely acknowledged, low breastfeeding rates remain an issue. In 2005, 45% of all mothers in the UK were breastfeeding exclusively at one week, while 21% were feeding exclusively at six weeks. At six months the proportion of mothers who were breastfeeding exclusively was negligible  $(<1\%)^3$ . Unfortunately these rates were even lower for women who delivered prematurely, largely due to the challenges they faced. In light of the evidence that preterm babies have even more to gain from receiving mother's own milk<sup>4,5</sup>, it is important to review the barriers to breastfeeding in these mothers.

The results of the Bliss Breastfeeding survey report showed that mothers of premature babies find expressing milk a positive and rewarding experience, but the continuity is often the biggest challenge<sup>6</sup>. The report highlighted that commitment from the neonatal teams is important to ensure that all mothers are properly supported to start expressing as early and often as possible, so that they have the best possible chance of fully breastfeeding later on<sup>6</sup>.

Higher levels of secretory IgA and anti-

infective properties in preterm mother's milk compared to the milk of a mother whose baby is born at term, mean that premature babies particularly benefit from breast milk, as it significantly reduces their short- and long-term risk and severity of infection, even when it is supplemented with human milk fortifier to meet their increased nutritional requirements<sup>5,7</sup>. A preterm mother's milk also contains higher quantities of medium chain triglycerides and long chain polyunsaturated fatty acids, which are beneficial for brain and eye development<sup>4</sup>.

Human milk is not only nutritional, but it is also critical to the growth and development of the infant's immune system, brain, and central nervous system. However in the immediate days after birth, before the milk comes in, it is the production and removal of colostrum which is so important, as this enables nonnutritional, trophic gut priming to mature the infant's vulnerable mucosal membrane. Therapeutic immunological compounds are also transferred from the mother in the colostrum to support the development of the infant's immune system and protect against many of the known risk factors of necrotising entercolitis (NEC)8. Colostrum is only produced in small quantities and so initially to ensure it is not lost some practitioners recommend to hand express first followed by pump expression to maximise the yield. However there is limited published evidence to support the effectiveness of hand expressing7.

Despite the support being provided to mothers of preterm babies, sometimes the



**FIGURE 1** 3D representations of the tissues of the lactating breast based on the ultrasound findings of Ramsay et al<sup>20</sup>. A) Ductal network, B) Distribution of glandular tissue and C) Complete 3D representation of all tissues. *Copyright Medela AG, 2006. Used with permission.* 

delay in a mother's milk "coming in" is unavoidable. In this situation donor human breast milk can be used if it is available, as it is a preferred choice to formula feeding. In this circumstance the baby can receive donated milk for a few days or weeks until breast feeding can be established. Milk banks provide a vital service to many mothers whose babies are born prematurely as they enable their babies to still get many of the benefits of breast milk. However, it is important to point out that the processing of human breast milk does have an impact upon the nutritional properties and some immunologically active components are deactivated<sup>9</sup>, although many enzymes, hormones, and growth factors are unchanged or minimally decreased10 and much of its nutritional and immunological value is still present, according to Goes et al (2002) cited in Hale and Hartmann<sup>2</sup>. In contrast preterm formulas provide only basic nutrition. Therefore, freshly expressed mother's own milk will always be first choice when available, but in the absence of mother's own milk, donor human milk is the next best option.

Following the 2005 infant feeding survey, further data collected by Renfrew in 2009 suggests that infants starting life in NICU are now more likely to receive breast milk or to be breastfed at one week than infants not admitted to NICU or SCBU, illustrating the influence of the support provided in NICUs and SCBUs to these mothers and their desire to give their infants the best possible start.

# Physiology of lactation and milk removal

An invaluable contribution to the latest understanding of infant sucking has been provided by Geddes<sup>11</sup>. Her research investigated the infant suck when removing milk from the breast. She reported that a vacuum is created to extract milk and the maturity of physical and neurological stability of the infant is required to co-ordinate a patent airway and the suck and swallow without the risk of aspiration and/or apnoea.

Milk removal is only made possible, however, if a woman's breast has successfully developed (**FIGURE 1**). The current understanding of the breasts' anatomical preparations for breast feeding identifies two significant stages<sup>12</sup>. In the early stages of pregnancy an increased presence of progesterone, oestrogen and prolactin causes intense lobular-alveolar growth. This results in extension and branching of the ductal network and an increase in the number of alveoli.

By mid pregnancy the proliferation of the glandular tissue into the adipose tissue leads to some secretory development, which continues to occur throughout the entire nine months of pregnancy. The epithelial cells of the alveoli differentiate into secretory cells for milk production and these alveoli distend with colostrum<sup>13</sup>. Colostrum increases in the alveoli and milk ducts throughout the second part of the pregnancy ready for the infant's first few days.

Following birth an immediate decrease of progesterone, oestrogen and human placental hormone (after the placenta is delivered), leads to a programmed sequence of elevated prolactin levels, insulin, adrenocorticoid hormones and oxytocin to initiate and maintain lactation9. However as the breast tissue at 25-30 weeks is not fully formed and mammary development is not complete, a delay in the production of these hormones can occur. Combined with the immature infant not being physiologically able to remove the milk directly from the breast, due to the inability to create an adequate vacuum<sup>11</sup>, feeding can become a real challenge.

### **Challenges facing preterm parents**

The anticipated and expected pregnancy journey for most pregnant mothers is to carry to full term, have a natural delivery, healthy baby, establish breastfeeding, early discharge and that mother, father and infant continue along the expected 0-5 year pathway.

When a pregnancy is interrupted early the anticipated pregnancy pathway is altered and the idealised journey changes course. Parents take a different route, into high risk delivery, and become dependent upon the expertise of medical and nursing staff. These parents are transported into an alien environment of neonatal intensive care, surrounded by high technical life saving equipment, alarms, and people talking in a different language of intravenous therapy, ventilation tubes, and phototherapy.

The 2009 POPPY report<sup>14</sup> found that the clinical care provided to infants in NICU in the UK is usually outstanding, however it did highlight the importance of parental support with non clinical issues that affect the family's journey throughout neonatal care as well. It identified that many parents' experiences of seeing their preterm baby was 'scary', and that they often had difficulties with separation from their baby<sup>14</sup> – this anxiety will only hinder the already difficult path of lactation.

Despite these sensitivities, it is vital that the health professionals caring for these families, approach the urgency to initiate lactation. The early discussion of human milk expression should be a priority in NICU as it is critical to the developmental, immunological and nutritional needs and is even said to be life saving for the extremely low birthweight infants. In an article from Rush University, Chicago, mothers claimed that by being able to provide milk for their baby helped them to feel that they were being useful and that



**FIGURE 2** Being able to feed their baby helps mothers to feel they are playing a part in their baby's care. *Photo courtesy of Marc Hardenberg.* 

they could play a part in their baby's recovery<sup>15</sup>. Providing support to mothers to feed can play a vital role during care (**FIGURE 2**).

# The vulnerability of the preterm Infant

Due to their immaturity, infants who are born early face challenges with, the respiratory, cardiovascular, neurological, immunological, hepatic, renal and gastrointestinal systems. Those born at 25 weeks are significantly less developed compared to those born at 30 weeks and subsequently are more susceptible to these issues.

A preterm infant has an underdeveloped gastro-intestinal tract (GIT) making them extremely vulnerable. Tolerance to milk feeds is often a time of transition until the GIT has matured and is able to digest and absorb the macro-nutrients found in both human and artificial formula milk. The immaturity of the gut associated with the preterm infant causes a significant increase in the risk of developing NEC (**FIGURE 3**), especially when associated with formula feeding.



FIGURE 3 Preterm baby with ileostomy for necrotising enterocolitis.

### Cost of NICU care and NEC

Renfrew et al<sup>7</sup> showed that formula fed, low birthweight, infants have five times the risk of developing NEC, with a 20% mortality risk and significant long-term healthcare costs among survivors<sup>14</sup>. A NICU intensive care bed costs on average £939 per patient/day<sup>7,15</sup>. The cost for a baby with a diagnosis for medical NEC is far greater, incorporating the basic housekeeping cost, infection screen and diagnosis with the addition of the surgical costs for drainage, laparoscopy, bowel reconstruction and potential long-term parental nutrition for short gut syndrome.

In a study in 1999 Schanler demonstrated that giving infants human milk could reduce their NICU length of stay<sup>5</sup>. The need for interventions such as antibiotic therapy and total parental nutrition was decreased and infants who were fed their mother's own milk were discharged two weeks earlier than infants who were fed preterm formula. Bisquera and colleagues provided additional evidence in their 2002 study to support the ability of breast milk to decrease the threat of NEC and significantly decrease hospital stays and therefore costs<sup>16</sup>.

In addition the provision of human milk fed to preterm infants decreased the risk of re-hospitalisation in the first year. Vohr et al<sup>17</sup> demonstrated that it also reduced the incidence of readmission due to respiratory illness within the first two years from 31.7% to 16.4%.

### **Initiation of lactation in NICU**

For a mother the decision to provide milk for her sick/preterm baby is based on very different factors from the decision to breastfeed a healthy, term infant. Initially following the delivery of a preterm or sick baby, the decision to express is made on the health-related benefits and mothers that had intended to use artificial formula feed will often rethink this decision upon guidance from healthcare professionals about the sheer potency of breast milk to premature babies.

However despite this desire to provide breast milk, mothers of preterms are faced with anatomical, physiological and emotional challenges when they initiate lactation<sup>18</sup>. The mother's decision to provide her own breast milk requires information, support by the NICU and a commitment by the mother.

Encouragement to initiate a programme of expressing is a great benefit to the mothers. They should be advised to express frequently in the first few days, using a hospital grade electric double pump as this has been shown to be the most important factor in establishing normal lactation (**FIGURE 4**)<sup>19</sup>. It is common for a mother of a preterm baby to find her milk supply decreases after a few weeks, as she resumes her normal daily routine. In order to limit this risk and enhance the volume of milk produced by a pumpdependent mother, she needs to be encouraged to follow a pattern of 8-12



**FIGURE 4** Breast pumps can help mothers to express milk.

expressions every 24 hours (Baby Friendly Initiative neonatal standards)<sup>20</sup> in the first two weeks postpartum. Not just frequency, but the pattern of breast pumping has been cited as having an influence on milk production and comfort. One study by Kent et al explored the response of the breasts of established breastfeeding mothers to different stimulation patterns<sup>21</sup>. A higher frequency pattern promoted a faster milk ejection reflex which was then followed by a slower expression sequence to extract the milk by vacuum<sup>9</sup> resulting in effective milk removal that was time efficient and comfortable.

#### Conclusion

There is little doubt that breast milk is best nutritionally and developmentally for babies and it can also be protective against infection and NEC, particularly important in preterm babies. However establishing lactation is notoriously difficult for mothers of preterm babies and they need a lot of support and encouragement from the health professionals around them to provide breast milk for their babies until the infants are able to suckle effectively. Use of a breast pump has been shown to be helpful in establishing lactation and a study about to be published by a team of researchers from Rush University Medical Centre, Chicago, led by Professor Paula Meier, has been exploring the varying methods of an infant's sucking methods at different stages after birth. The study aims to enhance our understanding of feeding an infant and initiate further technological developments to specifically support feeding the preterm infant.

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