



PREMATURE INFANT FEEDING

Every year globally, an estimated 15 million babies are born prematurely (or preterm) and this number is rising.¹

Preterm birth complications are the leading cause of death globally among children under five years of age.¹ However, thanks to advances in ante- and postnatal care, the overall survival rates for preterm infants has increased in England in recent years.² These infants are vulnerable and specialist paediatric dietitians have a crucial role to play in providing the nutritional support and intervention required to make sure the diet of these infants is effectively managed.

WHAT IS THE DEFINITION OF PRETERM OR PREMATURE BIRTH?

Preterm is defined as babies born alive before 37 weeks of pregnancy. There are sub-categories of preterm birth, based on gestational age.

Table 1: Preterm categories and related birthweights

| GESTATIONAL AGE | BIRTHWEIGHT The first weight of the newborn obtained ideally within one hour of delivery. ³ |
|---|---|
| Moderate to late preterm: 32 to 37 weeks | Low birthweight (LBW): <2.5kg |
| Very preterm: 28 to 32 weeks | Very low birthweight (VLBW): <1.5kg |
| Extremely preterm: less than 28 weeks | Extremely low birthweight (ELBW): <1.0kg |

WHAT ARE THE IMPLICATIONS OF PREMATURE BIRTH?

Missing some or all of the third trimester of pregnancy has a significant impact on an infant's growth and development. Therefore, these infants have higher nutritional requirements than term infants and need to be managed appropriately. Physiological and metabolic stresses, such as respiratory distress or infection, will also increase additional nutritional demands, all of which need to be carefully considered.^{4,5}

Low-to-moderately preterm (LMPT) infants have a two- to 10-fold increased incidence of mild-to-moderate morbidities compared with term infants. These morbidities include hypothermia, respiratory distress and jaundice.⁶ Premature infants are also prone to developing nutritionally-related neonatal morbidities such as hypoglycaemia, poor feeding, dehydration and malnutrition in the early neonatal period.⁶



THE IMPACT OF MALNUTRITION

Nutrition is essential for growth, metabolism and immunity in a preterm infant. Poor nutrition is associated with poorer head growth, which can result in poor psychomotor and mental skills, higher rates of cerebral palsy and autism. Impaired weight and growth in preterm infants are significantly associated with adverse neurodevelopmental outcomes in later life⁶ and infants with lower birth weight are at a higher risk of coronary heart disease, hypertension and type 2 diabetes in adulthood.⁷

Table 2: Nutritional requirements for the preterm infant.⁸ (Based on estimations from Tsang 2005⁹ and ESPGHAN 2019⁹.)

| Term infant | Preterm infant (Tsang 2005 ⁹) | | | Preterm infant 1-1.8kg (ESPGHAN 2019 ⁹) |
|---------------------|---|----------------|---------|---|
| | ELBW (<1kg) | VLBW (1-1.5kg) | | |
| Energy (kcal/kg) | 95-115 | 130-150 | 110-130 | 110-135 |
| Protein (g/kg) | 2 | 3.8-4.4 | 3.4-4.2 | 4.0-4.5 (<1kg) 3.5-4.0 (1-1.8kg) |
| Sodium (mmol/kg)* | 1.5 | 3.0-5.0 | 3.0-5.0 | 3.0-5.0 |
| Potassium (mmol/kg) | 3.4 | 2.0-3.0 | 2.0-3.0 | 2.0-3.5 |
| Calcium (mmol/kg) | 3.8 | 2.5-5.5 | 2.5-5.5 | 3.0-3.5 |
| Phosphate (mmol/kg) | 2.1 | 2.0-4.5 | 2.0-4.5 | 1.9-2.9 |

*Renal losses in the extreme preterm infant may require significantly more sodium supplementation than outlined above⁸



NUTRITIONAL MANAGEMENT

The nutritional management of preterm infants may have a major impact on growth and development.

Various feeding strategies are available, including the use of expressed maternal milk, donor human milk, breast milk fortifiers, adapted formula milks, enteral nutrition and total parenteral nutrition. However, a lack of robust evidence exists to guide practice for many of these interventions.¹⁰ Nevertheless, the first choice of human milk for feeding preterm infants is expressed breast milk from the mother, with the second choice being donor pasteurised human milk.^{8,11}

MATERNAL EXPRESSED BREAST MILK (MEBM)

When an infant can tolerate milk, breast milk should be the recommended choice of feeding for a preterm infant and breast milk expressed by the infant's mother is the gold standard of care.^{6,8} Breast milk offers many health benefits for premature infants, including providing antibodies to help mature the infant's gut and immune system, reducing the risk of necrotising enterocolitis (NEC)¹² long-term morbidity, poor growth and neurodevelopment.¹⁴

The nutrient content of expressed breast milk varies depending on the stage of lactation at which it is collected.¹⁰ Milk from women who deliver prematurely differs from that of women who deliver at term. Preterm milk is initially higher in protein, fat, free amino acids and sodium, but over the first few weeks following delivery these levels decrease.¹³

Table 3: Typical nutritional contents of human expressed breast milk (per 100 ml)^{*10}

| Nutrient | Milk expressed from lactating breast | Drip milk expressed from opposite breast |
|----------------|--------------------------------------|--|
| Energy (kcal) | 73 | 54 |
| Protein (g) | 2.7 | 1.3 |
| Fat (g) | 3.0 | 2.2 |
| Calcium (mg) | 29 | 28 |
| Phosphate (mg) | 15 | 14 |

*Data from Rennie J, Robertson NRC. A Manual of Neonatal Intensive Care, 4th ed, London: Arnold, 2002

TUBE FEEDING

If an infant is under 35 weeks gestational age, or too immature to suckle, enteral feeding using a nasogastric (via nose to stomach) or orogastric (via mouth to stomach) tube is the recommended method of nutrient provision for preterm infants in the first days of life.^{20,25} Human breast milk from the infant's mother is the recommended form of enteral nutrition for the preterm, or expressed milk from donor mothers who have delivered term infants.¹⁰

During the first days of life, only very small amounts of milk are administered until the intestines adjust.²⁵ Once the infant is mature enough to suckle (around 35 weeks), tube feeding may continue whilst the infant is learning to breastfeed or bottle feed, to ensure sufficient nutrition.¹⁹

"Enteral nutrition should be advanced as rapidly as tolerated and should increasingly replace parenteral nutrition. When both enteral and parenteral nutrition are considered, enteral nutrition should always be prioritised."²⁵

PARENTERAL NUTRITION

In the immediate postnatal period, parenteral nutrition provides nutrition through the veins (into the bloodstream) to babies who can't be adequately fed by mouth or through a feeding tube.²⁵ Most preterm babies need some parenteral nutrition because the amount of enteral nutrition that can be provided during the first days does not meet their nutrient needs. Partial parenteral nutrition is often provided combined with some enteral nutrition (fortified human milk or preterm formula).²⁵

The duration of parenteral nutrition depends on how quickly enteral nutrition is advanced and how soon the baby can tolerate full enteral feeding.²⁵ This depends on the prematurity of the infant and whether they have digestive problems. Neonatal parenteral nutrition may also be used for infants whose feeds are being withheld because NEC is present or suspected, or for critically ill infants and infants with gastrointestinal disorders who require surgery.^{18,21}

Table 4: Indications for starting neonatal parenteral nutrition (NICE G154)²¹

| INDICATIONS | TIMING |
|--|---|
| For preterm babies born before 31+0 weeks, start neonatal parenteral nutrition. | When a preterm or term baby meets the indications for parenteral nutrition, start it as soon as possible, and within eight hours at the latest. |
| For preterm babies born at or after 31+0 weeks, start parenteral nutrition if sufficient progress is not made with enteral feeding in the first 72 hours after birth. | |
| Start parenteral nutrition for preterm and term babies who are unlikely to establish sufficient enteral feeding, for example, babies with: <ul style="list-style-type: none"> – a congenital gut disorder; – critical illness such as sepsis; – and there is unlikely to be sufficient progress with enteral feeding within a further 48 hours. | |





DONOR EXPRESSED BREAST MILK (DEBM)

In the absence of a mother's own expressed breast milk, donor breast milk can generally be the milk of choice with parental consent required. There are significant challenges, however, in providing donor human milk for all premature infants whose mothers are unable to provide an adequate supply of their own milk.¹⁵ These challenges include nutrition as DEBM is often low in protein, fat and bioactive molecules compared with preterm milk from the first few weeks after delivery, and immune protection with regards to the potential for cross-transmission of infectious agents.

Milk banks have rigid standards for screening and testing DEBM. NICE clinical guideline 93 offers best practice advice on the operation of these services in clinical settings.¹⁶

EXPRESSED BREAST MILK FORTIFIER

Preterm infants who weigh less than 1.5kg will not be able to meet their nutritional needs using expressed breast milk alone.¹² For these infants, expressed breast milk should be fortified to increase the protein content, along with the addition of vitamins and minerals. Fortification of human milk with calcium and phosphate may improve bone mineral content, whilst protein and energy supplementation of human milk increases the rate of weight gain and head growth, at least in the short term.¹²



PRETERM FORMULA

A mother's milk supply is not affected by premature birth. However, having a preterm infant can increase stress and fear for a mother, which, in turn, can lead to difficulties in milk production. If a mother cannot breastfeed, or if a mother chooses not to breastfeed, a specialist ready-to-feed preterm formula should be used.¹⁷ These formulas have been specifically developed to meet the additional nutritional needs and metabolic requirements of preterm infants.

Points to consider:^{18,19}

- A preterm formula should be used in infants who are less than 2kg in weight and under 35 weeks gestational age and not receiving breast milk.
- A preterm formula should be used until the infant has reached a body weight of 2-2.5kg and/or discharged.

SPECIALISED TERM FORMULAS

Specialised term formulas are not designed for preterm infants and so should only be used where absolutely necessary and ideally under the direction of a paediatric and neonatal dietitian. All powdered feeds should be made up in accordance with use of powdered feeds in a hospital environment guidelines.^{22,23} Soya formulas are not recommended for infants unless specifically required for treatment of galactosaemia or as part of a vegan diet.

REFERENCES

Please visit: www.NHDMag.co.uk/article-references.html

ESSENTIAL RESOURCES

NICE guideline [NG154]. Neonatal parenteral nutrition. <https://www.nice.org.uk/guidance/ng154>

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