Pēpi Whānau Wawe Nutrition Guideline

A National Nutrition Guideline for Preterm Babies

Breastfeeding, Whānau & Monitoring

Breastmilk and Breastfeeding

Expressing: Mothers should be supported to express early (<6 hours post birth), frequently (≥8 times/day) and by double pumping their breastmilk throughout their neonatal unit stay.

First feed: Babies should receive only mother's own milk for the infant's first feed whenever possible, to support the continuation of breastmilk expressing and breastfeeding.

Lactation consultants: Specialist neonatal lactation consultants should be embedded within the multidisciplinary neonatal care team.

Skin-to-skin care (ongoing and prolonged) should be initiated as early and as often as possible, prioritising mother–baby contact to support lactation, while actively encouraging fathers or partners to provide skin-to-skin care when the mother is unavailable or in addition to maternal contact.

Staff-led support: Provide timely, proactive, specialised staff-led breastfeeding support, additional targeted staff training and involvement of all NICU staff in lactation and breastfeeding support as an addition to standard care to improve breastfeeding outcomes.

Early education on breastfeeding should be part of routine postnatal care, given the benefits of breastfeeding for babies and mothers. Breastfeeding information, discussion and advice should also be included in routine antenatal care.

Mana-enhancing tikanga practices that support whānau Māori breastfeeding and Te Ao Māori values (e.g. whanaungatanga, manaakitanga) should be incorporated as part of good clinical care to support breastfeeding. Māmā Māori would like to have a whānau approach (e.g. include kuia, sisters, partner) to support breastfeeding.

Monitoring of Nutrition and Growth

Growth measurement: Measure weight, length and head circumference at least weekly. Use calibrated digital scales (to nearest 5 g) for weight, a neonatometer for length (to nearest mm) and non-stretch tape for head circumference. Apply Fenton 2025 growth charts from birth to 50 weeks postmenstrual age, then switch to WHO standards. Correct for gestational age up to 2 years.

Faltering growth: Assess after 2–3 weeks of age, and once birthweight is regained. Use these recommendations to screen for and intervene to resolve faltering growth – weight z-score change from birth. To calculate z-score, use the NeoGrowth Fenton 2025 mobile phone application. Babies with mild malnutrition (loss of >0.8 z-score) may require a higher feed volume/nutrient intake. Babies with moderate malnutrition (loss of >1.2 z-score) should be referred to a neonatal dietitian for individual assessment of their growth and intervention if needed.

Fetal growth restriction: Nutritional management and growth assessment for babies born with fetal growth restriction and/or SGA should be the same as those born AGA, although initial weight loss is often less.

Neonatal dietitians who meet the Australasian Neonatal Dietitians Network skill requirements for the level of neonatal care should be embedded within the multidisciplinary neonatal care team.

Whānau Education and Involvement

Whānau Māori should be included and are essential members of the team caring for their pēpi. Healthcare professionals need to communicate in a culturally safe way, as determined by whānau Māori. Incorporating Māori values (e.g. whanaungatanga (connectedness) and manaakitanga (kindness and hospitality)) when providing healthcare will contribute to increasing health equity for whānau Māori.

Pacific families should be regarded and therefore included as essential members of the team in nutrition care discussions for their pēpi. Healthcare professionals should communicate as determined by Pacific families and include relationship-centred, culturally safe communication that nurtures and recognises this value, Teu Le Vā, respects and supports expressions of faith and spirituality, and actively includes extended family members who are central to decision-making.

Whānau-led tikanga around food should be integrated into supporting whānau Māori in the nutritional care of pēpi Māori. Kai is an important aspect of tikanga Māori. It is important that manaakitanga is extended to both pēpi and whānau Māori; therefore, ensure whānau have access to an area to prepare and share kai. When possible, if there is more than one whānau member in NICU, offer more than one meal to the whānau.

Involve parents in tube feeding (feeding, changing tubes and using feeding pumps if needed) and preparing supplements (fortification and similar supplements) for their babies, as this may enhance parental confidence, engagement and satisfaction with care.

Education delivery: Alongside standard care, additional education for parents should be through a mix of delivery methods (face-to-face, written, online) and tailored to cultural and contextual needs.

"Poipoia te kākano kia puāwai

Nurture the seed and it will bloom."

Parenteral Nutrition

Who needs parenteral nutrition: For babies born <31^{+0} weeks, start neonatal parenteral nutrition. For babies born ≥31^{+0} weeks, start parenteral nutrition if sufficient progress is not made with enteral feeding in the first 72 hours after birth.

For babies on enteral feeds, start parenteral nutrition if:

- enteral feeds need to be stopped and it is unlikely they will be restarted within 48 hours.
- enteral feeds have been stopped for more than 24 hours and there is unlikely to be sufficient progress with enteral feeding within a further 48 hours.

Use 10% glucose instead of parenteral nutrition for moderate-to-late (32^{+0} to <37 weeks' gestation) preterm babies whose mother's own breastmilk is not available after birth, while waiting for mother's breastmilk. Parenteral nutrition should be reserved for babies with a specific clinical indication.

How soon: When a preterm baby meets the indications for parenteral nutrition, start it as soon as possible, and within 8 hours at the latest.

How much fluid: Either lower or higher parenteral fluid volumes may be used, guided by the infant's condition, humidity settings, local protocols and biochemical results.

Minimum glucose load to maintain metabolic homeostasis or prevent hypoglycaemia is 4 to 8 mg/Kg/minute.

Hyperglycaemia: Either insulin or glucose reduction may be used for managing hyperglycaemia. The choice should be guided by clinical judgement, local protocols and the availability of close monitoring, as the evidence does not favour one approach over the other.

Lipid in sepsis: The reduction of lipid emulsion during episodes of sepsis is not recommended. When a baby is at risk of hypertriglyceridaemia, e.g. has a lipaemic blood sample, triglycerides should be monitored.

Fish oil-only-based lipid should not be used for preventing liver disease but may be useful as rescue therapy in babies with established or evolving intestinal failure-associated liver disease.

When to stop: Parenteral nutrition should continue until an enteral feed volume of ≥120 mL/Kg/day has been reached. Ceasing parenteral nutrition at a lower volume of enteral feed (e.g. 60 to 100 mL/Kg/day) is not recommended.

Hang time (standard solutions): Aqueous phase – at least 48 hours and up to 96 hours. Lipid emulsion – up to 48 hours.

Iodine: Routine additional iodine supplementation is not recommended. Iodine supplementation may be considered for babies who are at risk of iodine deficiency and reliant on parenteral or low-iodine enteral nutrition.

Initiate Parenteral Nutrition on Day 1 – Adjust for Tolerance and Clinical Condition

Component	Recommendation
Energy	• Give a starting range of 40 to 60 kcal/Kg/day • Gradually increase to a maintenance range of 75 to 120 kcal/Kg/day • If starting parenteral nutrition more than 4 days after birth give 75 to 120 kcal/Kg/day
Carbohydrate	• Give a starting range of 6 to 9 g/Kg/day (~4 to 6 mg/Kg/min) glucose • Gradually increase to a maintenance range of 9 to 16 g/Kg/day (6 to 11 mg/Kg/min) • If starting parenteral nutrition more than 4 days after birth give 9 to 16 g/Kg/day (6 to 11 mg/Kg/min)
Protein	• Give a starting range of 1.5 to 2 g/Kg/day amino acid • Increase to a maintenance range of 3 to 4 g/Kg/day • If starting parenteral nutrition more than 4 days after birth give 3 to 4 g/Kg/day
Protein: energy ratio	• Ensure protein: energy ratio is 23 to 34 kcal of total energy per g amino acid
Lipid	• Give a starting range of 1 to 2 g/Kg/day and gradually increase to 3 to 4 g/Kg/day • To prevent essential fatty acid deficiency a lipid emulsion dose providing a minimum linoleic acid intake of 0.25 g/Kg/day should be given (~1.5 g/Kg/day SMOFLipid) • Parenteral LC-PUFA supplementation is recommended where LC-PUFA-containing lipid emulsion products are available and cost-effective, e.g. SMOFLipid

Electrolytes, minerals, trace elements and vitamins: Provide parenteral electrolytes, minerals, trace elements and vitamins in accordance with ESPGHAN 2018 recommendations for preterm babies. As Aotearoa NZ soil is deficient in iodine, selenium and zinc, use the mid to upper half of the recommended intake.

Nutrient	Intake/Kg/day
Sodium	2 to 7 mmol (<1500 g); 2 to 5 mmol (>1500 g)
Potassium	2 to 3 mmol
Chloride	2 to 5 mmol
Calcium	1.6 to 3.5 mmol
Phosphorus	1.6 to 3.5 mmol
Magnesium	0.2 to 0.3 mmol
Iron	200 to 500 µg
Zinc	400 to 500 µg
Copper	40 µg
Iodine	1 to 10 µg
Selenium	7 µg
Manganese	≤1 µg
Molybdenum	1 µg

Vitamin	Intake/Kg/day
Vitamin A	227 to 455 µg (700–1500 IU)
Vitamin D	2 to 10 µg (80–400 IU)
Vitamin E	2.8 to 3.5 mg
Vitamin K	10 µg
Vitamin C	15 to 25 mg
Thiamin	350 to 500 µg
Riboflavin	150 to 200 µg
Pyridoxine	150 to 200 µg
Vitamin B12	0.3 µg
Niacin	4 to 6.8 mg
Folic acid	56 µg
Pantothenic acid	2500 µg

LC-PUFA long-chain polyunsaturated fatty acid · IU international unit

Biochemical Monitoring

Biochemical Monitoring – Parenteral Nutrition

Investigation	Neonatal Reference Range	Before Clinical & Metabolic Stabilisation		Once Clinically & Metabolically Stable		
		Every 1–2 Days	As required*	Every 1–2 Weeks	After 1 Month on Parenteral Nutrition, Then Monthly	As required*
Glucose	2.6–6.5 mmol/L	X		X		
Blood gases (capillary)	pH 7.35–7.45, PCO_2 4.7–6.0 kPa, HCO_3 22–26 mmol/L	X		X		
Sodium	134–148 mmol/L	X		X		
Potassium	4.5–6.0 mmol/L	X		X		
Chloride	90–114 mmol/L	X				X
Calcium	Total 1.8–2.1 mmol/L, Ionised 1.15–1.45 mmol/L	X			X	
Phosphorus	1.4–2.5 mmol/L (see footnote for frequency)	X			X	
Magnesium	0.7–1.0 mmol/L		X			X
Zinc	9–17 µmol/L		X			X
Total protein	45–75 g/L		X			X
Albumin	25–40 g/L		X			X
Urea	1.0–4.0 mmol/L		X			X
Creatinine	<95 µmol/L		X			X
Triglycerides	<3 mmol/L		X			X
Bilirubin (conjugated)	<20 µmol/L		X		X	
AST	<80 U/L		X		X	
ALT	<45 U/L		X		X	
GGT	<150 U/L		X		X	
ALP	80–600 U/L (up to 1000 U/L in growth phase)		X		X	
PTH	1.7–7.3 pmol/L		X		X	
Vitamin A	0.7–1.5 µmol/L (200–430 µg/L)		X		X	
Vitamin B12	170–800 pmol/L		X		X	
Vitamin D	50–150 nmol/L		X		X	
Vitamin E	11–46 µmol/L Auckland 5–50 µmol/L Waikato 23–70 µmol/L Christchurch		X		X	
INR	Lab-dependent norm		X		X	
Trace elements: Se, Zn, Cu	Lab-dependent norms					X
C-reactive protein	0–5 mg/L		X			X
Iron	10–31 µmol/L		X			X
Ferritin	15–400 µg/L		X			X
Urine electrolytes	Urinary Na >30 mmol/L adequate for growth					X

AST aspartate aminotransferase · **ALT** alanine aminotransferase · **GGT** gamma-glutamyl transferase · **ALP** alkaline phosphatase · **INR** international normalised ratio (an elevated INR may indicate vitamin K deficiency) · **PTH** parathyroid hormone. Neonatal reference ranges are those of the reporting laboratories. *No routine monitoring is recommended. Individualised monitoring may be needed based on the clinical situation.

Monitoring for refeeding syndrome: For babies with a birthweight <1500 g or <10th centile, monitor serum phosphate and calcium on days 3, 5 and 7 and then on alternate days until commenced on fortified breastmilk or preterm formula.

Urea: Limiting amino acid intake based on serum urea alone is not warranted. Urea levels up to 14 mmol/L may be considered acceptable in babies on parenteral nutrition provided there are no other parameters to suggest protein intolerance (e.g. hyperammonaemia >122 µmol/L).

Triglycerides: The routine monitoring of plasma triglyceride concentrations is not recommended.

Biochemical Monitoring – Enteral Nutrition

Zinc: Consider measuring serum zinc in babies with faltering growth and low serum alkaline phosphatase, especially if they have excessive gastrointestinal fluid losses.

Urea: Plasma urea concentration can be used to indicate whether standard breastmilk fortification is sufficient to support appropriate growth. More protein may be needed if a baby has faltering growth and their serum urea is <2.0 mmol/L.

Urinary sodium: Consider measuring urinary sodium in infants with faltering growth and normal serum sodium.

Bone mineral status: Phosphorus, calcium, ALP and parathyroid hormone status should be monitored regularly – as above.

Vitamin D: Serum Vitamin D (25-hydroxyvitamin D) should be measured at one month of age in babies born before 32 weeks' gestation or birthweight <1500 g. If low, adjust dose and monitor every 10–14 days until well inside the reference range.

Enteral Nutrition

Initiate enteral feeding within 24 hours of birth. Use mother's own milk where possible, followed by donor human milk and then preterm formula if no human milk is available. Use the gastric route and intermittent bolus feeding. Start with 10–20 mL/kg/day and increase by at least 24 mL/kg/day depending on tolerance.

Moderate-to-late preterm: In moderate-to-late preterm babies wait as long as is clinically feasible for mother's own milk. This may be at least 3 days from birth. Give 10% IV glucose while waiting for mother's own milk. Donor milk or infant formula is not recommended unless there is a specific clinical indication.

Donor breastmilk (unpasteurised from a screened donor, or pasteurised) is preferred over infant formula for all preterm babies with insufficient mother's own expressed breastmilk. Very low birthweight and extremely preterm babies benefit most.

Smell and taste of breastmilk or infant formula should be provided before all enteral tube feeds.

Fortify expressed breastmilk for babies who are born at <32 weeks or <2000 g birthweight.

Fortification of breastmilk at full strength should begin at around 75–100 mL/Kg/day of enteral feeds, or once a feed volume of at least 5 mL is reached, rather than at lower volumes.

Preterm formula rather than term formula should be used for babies born at <32 weeks or birthweight <2000 g when breastmilk is not available or is insufficient.

Full enteral feeds of 180 mL/Kg/day should be used for extremely low birthweight babies (birthweight <1000 g). Higher enteral volume may be needed if growth is faltering. For other babies, give the fluid intake that is needed for appropriate growth (more details below).

Continue fortifier / preterm formula until preparing for discharge or until weight gain is excessive. Stopping breastmilk fortifier or preterm formula at a specific weight or gestational age is not recommended.

Continuous feeds should not be used routinely.

Standardised fortification should be used over routine individualised fortification of expressed breastmilk. Human milk-based fortifier is not recommended to fortify expressed breastmilk.

Osmolality: Enteral feeds should be selected based on factors other than osmolality. However, if the osmolality is very high (>600 mOsm/Kg), consider practical steps to lower it, such as divided medication doses.

Zinc: Routine enteral zinc supplementation (5 to 10 mg/day) should be used for all preterm babies while in neonatal care.

Vitamin D: Routine enteral vitamin D supplementation is recommended. The suggested dose is 2 drops (800 IU) cholecalciferol per day for all preterm babies, reducing to 1 drop (400 IU) cholecalciferol at discharge or 40 weeks gestational age. Routine supplementation of other vitamins is not supported by the evidence.

Enteral nutrient intakes (ESPGHAN 2022): Provide enteral nutrient intakes for preterm babies according to ESPGHAN 2022 guidance. Use individualised plans considering gestational age, tolerance and clinical status. Monitor growth (more details below) and biochemical markers routinely. As Aotearoa NZ soil is deficient in iodine, selenium and zinc, use the mid to upper half of the recommended intake.

Enteral Nutrient	Recommended Intake/Kg/day
Energy	115 to 140–160 kcal
Protein	3.5 to 4.0–4.5 g
Carbohydrates	11 to 15–17 g
Lipids	4.8 to 8.1 g
Sodium	3.0 to 5.0–8.0 mmol
Chloride	3.0 to 5.0–8.0 mmol
Potassium	2.3 to 4.6 mmol
Calcium	3.0 to 5.0 mmol
Phosphorus	2.2 to 3.7 mmol
Magnesium	0.4 to 0.5 mmol
Iron	2.0 to 3.0–6.0 mg
Copper	120 to 230 µg
Selenium	7 to 10 µg
Manganese	1 to 15 µg
Iodine	11 to 55 µg
Zinc	2 to 3 mg

Enteral Nutrient	Recommended Intake/Kg/day
Chromium	0.03 to 2.25 µg
Molybdenum	0.3 to 5.0 µg
Thiamine (B1)	140 to 290 µg
Pantothenic acid	0.6 to 2.2 mg
Biotin	3.5 to 15 µg
Niacin	1100 to 5700 µg
Vitamin C	17 to 43 mg
Riboflavin (B2)	200 to 430 µg
Pyridoxine	70 to 290 µg
Folic acid	23 to 100 µg
Cobalamin (B12)	0.1 to 0.6 µg
Vitamin A	400 to 1000 µg (1332 to 3330 IU)
Vitamin D	10 to 25 µg (400 to 1000 IU)
Vitamin E	2.2 to 11 mg
Vitamin K	4.4 to 28 µg

Not Recommended

- Routine measurement of gastric aspiration volumes before enteral feeds to monitor feed tolerance.
- Withholding feeds for transfusion, extubation or eye screening examinations – continue providing feeds unless there is a clinical indication to do otherwise.
- Routine enteral protein supplementation (in addition to breastmilk fortification). Aim for the ESPGHAN recommended enteral protein intake of 3.5 to 4.0 g/Kg/day, which may be increased to 4.5 g/Kg/day where growth is too slow.
- Routine enteral supplementation of breastmilk with glucose polymer powder.
- Routine enteral fat supplementation. Enteral fat supplementation may be beneficial when there is a high energy requirement and faltering growth, but should not be used where there is insufficient feed volume and an inadequate intake of other nutrients, such as protein, vitamins and minerals.

Guideline Development Group. Pēpi Whānau Wawe Nutrition Guideline: A National Nutrition Guideline for Preterm Babies. Liggins Institute, University of Auckland Waipapa Taumata Rau, Auckland, New Zealand; August 2026.
See our website for further details.

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