

NUTRITION

AIMS

- To achieve growth and nutrient accretion similar to intrauterine rates
- To achieve best possible neurodevelopmental outcome
- To prevent specific nutritional deficiencies

Target population

Preterm infants, especially birth weight <1500 g

NUTRITIONAL REQUIREMENTS

Daily recommended intake of nutrients for stable/growing preterm infants

	<1000 g	1000 to 1500 g
Fluids (mL/kg)	160–220	135–190
Energy (kcal/kg)	130–150	110–130
Protein (gm/kg)	3.8–4.4	3.4–4.2
Protein energy ratio	3.3 g/100 kcal	2.8 g/100 kcal
Sodium (mmol/kg)	3–5	3–5
Calcium (mmol/kg)	2.5–5.5	2.5–5.5
Phosphorus (mmol/kg)	1.9–4.5	1.9–4.5
Vitamin A (IU/kg)	700– 500	700–1500
Vitamin D (IU/kg)	150–400	150–400

FEEDING GUIDE

Nutrient composition of commonly used milks per 100 mL

	Preterm breast milk	Fortified breast milk (Nutriprem)	SMA LBW	Nutriprem 1
Energy (kcal)	60–74	76–90	82	80
Protein (g)	1.4–1.9	2.2–2.7	2.2	2.4
Sodium (mmol)	0.6–1.7	1.0–2.1	1.8	1.8
Calcium (mmol)	0.6–1	2.2–2.6	2.5	2.5
Phosphorus (mmol)	0.35–0.6	1.7–2.0	1.9	1.6

Route of administration

- Most infants <34 weeks cannot co-ordinate sucking, swallowing and breathing effectively and must be tube fed
- use gastric feeding with either nasogastric or orogastric tube

Feeding schedules

- Gastrointestinal tolerance of feeding is very variable and concomitant illness can impose additional constraints, manage feeding on an individual basis
- Following are general guidelines

BIRTH WEIGHT <1000 g

Day 0

- Commence glucose solution 10% 90 mL/day IV
- Establish central venous access (UVC or long line). See **Umbilical venous catheterisation** guideline or **Long line** guideline

Day 1

- Adjust fluid volume depending on baby's clinical condition, weight, urine output and serum electrolytes and creatinine (see **IV fluid therapy** guideline)
- Commence total parenteral nutrition (TPN), see **Parenteral nutrition** guideline

Day 2-5

- Increase fluid volume to 150 mL/kg/day taking into consideration:
 - clinical condition
 - weight profile
 - urine output
 - serum electrolytes
 - renal function
- Commence enteral feeds if:
 - clinical condition stable
 - not receiving significant inotropic support (dopamine >5 microgram/kg/min or adrenaline)

**Presence of umbilical catheters is not a contraindication for feeding.
In presence of absent or reversed end-diastolic flow on antenatal scans, be more cautious with enteral feeding (see Special situations)**

Type of milk

- Wherever possible, use expressed breast milk for initiation of enteral feed. Breast milk remains the ideal milk for both term and preterm infants and should be strongly recommended. However, support mothers in whatever choice they make
- in its absence, use preterm milk formula (SMA LBW, Nutriprem 1)

Volume

- Stop feeds if not tolerated

Day of feeding	Volume of milk (mL)	
	Birth weight <750 g	Birth weight 750–999 g
0–1	0.5 mL hrly†	0.5 mL hrly
2	0.5 mL hrly	1 mL hrly
3	1 mL hrly	1.5 mL hrly
4	1.5 mL hrly	2 mL hrly *
5	2 mL hrly *	3 mL hrly
6	2.5 mL hrly	4 mL hrly
7	3 mL hrly	5 mL hrly
8	3.5 mL hrly	6 mL hrly
9	4 mL hrly	6.5 hrly #
10	4.5 mL hrly #	6.5 hrly #

† <500 g, 0.25 mL/hr

* At this stage, include enteral feeds in total intake of fluids

If required

If receiving expressed breast milk

- Add fortifier (human breast milk fortifier) when milk tolerated at 150 mL/kg/day for 24 hr when baby reaches 10 days
- Observe for signs of feed intolerance (abdominal distension, vomiting, increased aspirates, change in stool frequency) for next 24 hr
- Thereafter, increase volume of milk gradually to 180-220 mL/kg/day as necessary

If receiving preterm milk formula

- 150 mL/kg/day should suffice
- If necessary, increase to 180 mL/kg/day on consultant advice

Nutrient additives

Multivitamins once full enteral feeds established

- Exclusively breastfed babies:
 - 0.6 mL Abidec (**NB** contains peanut oil) or Dalavit
 - 50 microgram folic acid daily and Joulie's phosphate 0.5 mL 12 hrly adjusted to phosphate concentration
- Formula feeds:
 - 0.3 mL Abidec or Dalavit

Iron

- At six weeks old and only for breastfed babies <1.8 kg at birth, start sodium ferredetate (e.g. Sytron) once daily:
 - <3 kg, 1 mL
 - >3 kg, 2.5 mL

BIRTH WEIGHT 1000–1500 g

- On day 0 commence glucose 10% IV in addition to enteral feeds
- Consider need for TPN if:
 - birth weight <1250 g
 - clinically unstable
 - on inotropic support
 - absent/reversed end-diastolic flow
 - full enteral feeds seem unlikely to be achieved by day 5
- Use expressed breast milk or, if not available, preterm milk formula
- Increase volume of feeds every 12–24 hr keeping rate of increment <20 mL/kg/day
- Follow guidelines on fortification of EBM and addition of other nutrients as above

WELL INFANTS >1500 g BIRTH WEIGHT

- Usually tolerate 2–3 hrly enteral feeds soon after birth. Start with 60–90 mL/kg/day
- Increase feeds as tolerated up to 30 mL/Kg/day to reach full feeds by day 4–5
- In babies <35 weeks' gestation, start multivitamins and sodium ferredetate (e.g. Sytron) as above

SUCK FEEDS

- Around 34 weeks' corrected gestational age, introduce such feeds after increasing feed interval to 3 hrly
- Some babies can be started early if experienced nursing staff deem them interested and capable

CHANGEOVER OF MILK ON REACHING 2 kg WEIGHT

- If feeding on fortified EBM, stop fortifier and monitor weight closely
- If feeding on preterm milk, change to term formula

MONITORING

Monitoring of gastrointestinal tolerance, growth and biochemical balance is critical in nutritional management of preterm infants

Clinical monitoring

- Daily assessment of gastrointestinal tolerance:
 - gastric residues
 - stool frequency
 - abdominal examination as appropriate

Anthropometry

- Monitor weight daily for first few days to assist with fluid management (see **Fluid management** guideline)
- once clinically stable, measure weight twice weekly
- weight gain of 15-20 g/kg/day is adequate in growing phase
- Measure head circumference weekly to assess cerebral growth
- Document weight and head circumference regularly on growth chart

Biochemical monitoring

- In sick or very premature infants, measure plasma urea, electrolytes, calcium, phosphate and albumin twice daily for initial few days. Reduce frequency depending on clinical stability
- Monitor glucose closely in initial few days

- once clinical stability and full enteral feeds achieved, carry out these tests at least once a week in VLBW infants
- Check urine once weekly for excretion of sodium and phosphate

COMMON PROBLEMS

Poor growth

- Babies with weight gain <15 g/kg/day require further assessment
- Ensure baby receiving adequate nutrition (energy intake >120 kcal/kg/day; protein 3.3 g/100 kcal). Calculate energy and protein intake per kg/day
- Check for following factors, that may affect growth:
 - clinical illness (e.g. UTI)
 - medications (diuretics, corticosteroids)
 - increased energy requirement resulting from respiratory/cardiac disorders
 - hyponatraemia
 - anaemia

Excessive weight gain

- Babies with weight gain >25 g/kg/day require further assessment
- Ensure measurement not spurious and not related to catch-up growth after a period of poor weight gain
- Evaluate for fluid retention and its causes
 - consider diuretics in presence of oedema
- If receiving >150 kcal/kg/day, reduce energy intake
- if applicable, change preterm milk to term formula, or decrease volume of feeds

Feeding intolerance

- Intolerance to feeding is common among small preterm infants and most will have episodes requiring either temporary discontinuation of feeding or delay in advancing feeds
- Carefully observe for signs of necrotising enterocolitis (NEC) including abdominal distension, discolouration, blood in stools, metabolic acidosis (see **Necrotising enterocolitis** guideline)

Gastric aspirates

- If aspirates non-bilious and less than half the volume of previous feed, they can be replaced and feeding continue while observing infant closely
- If aspirates bilious or more than half previous feed volume, consider withholding feeds on that occasion and assess for any signs of NEC

SPECIAL SITUATIONS

Reversed end diastolic flow

- Start enteral feeds when clinically stable
- **Birth weight <1000 g**, advance feeds using schedule above for babies with birth weight <750 g
- **Birth weight 1000–1500 g**, advance feeds using above schedule for babies with birth weight 750-999 g
- Monitor closely for signs of feed intolerance or NEC

Patent ductus arteriosus (PDA)

- Preterm infants with PDA have decreased blood-flow in descending aorta and increased risk of NEC. Indometacin is also associated with decreased gastrointestinal blood supply by Doppler ultrasound scan measurements. Observe closely for feeding intolerance and signs of NEC
- As increased IV fluid rates are associated with PDA, avoid any increase >150 mL/kg/day
- Cautiously increase feeds while receiving indometacin

POST DISCHARGE NUTRITION

Nutrient supplements

- Infants <35 weeks gestation, give multivitamins (Abidec) after first week, once full enteral feeds established. Continue for first 12 months (not required if Nutriprem 2 used as primary nutrition)
- Offer iron supplements sodium ferredetate (e.g. Sytron) 1 mL once daily, to breast milk fed babies of birth weight <1800 g, continuing until mixed feeding established

Formula

- Consider post-discharge follow-on preterm milk (e.g. Nutriprem2) in babies with:
 - chronic lung disease
 - restricted intake (e.g. congenital heart disease)
 - poor growth