NUTRITION AND ENTERAL FEEDING ● 1/9

PRINCIPLES

- Maternal breast milk (MBM) is the optimal feed for all babies. Mothers should be counselled and supported to express milk as soon as possible after birth and frequently thereafter to ensure adequate supply for baby
- Compared to formula milk maternal colostrum and breast milk reduce rates of mortality, BPD and ROP, reduce risks of NEC and sepsis and improves neurodevelopmental outcomes
- Early enteral feeds promote normal gastrointestinal structure and function, motility and enzymatic activity
- Delayed nutrition can result in growth restriction with long-term complications of parenteral nutrition, dysbiosis of the intestine, poor organ growth and poorer neurological outcomes
- Manage feeding on an individual basis dependent upon gastrointestinal tolerance and availability of maternal breast milk
- This guideline is designed to be used in conjunction with individual clinical assessment processes

NUTRITIONAL REQUIREMENTS

Table 1: Daily recommended intake of nutrients for stable growing term and preterm babies

Nutrient	Term baby	Preterm baby (ESPGHAN 2022)
Energy (kcal/kg/day)	95–115	115–140 (160*)
Protein (g/kg/day)	2	3.5–4.0 (4.5*)
Sodium (mmol/kg/day)	1.5	3.0–5.0 (8.0*)
Potassium (mmol/kg/day)	3.4	2.3−4.6
Calcium (mmol/kg/day)	3.8	3.0−5.0
Phosphorus (mmol/kg/day)	2.1	2.2−3.7
Zinc(mg/kg/day)	4.0 (mg/day)	2.0−3.0
Iron (mg/kg/day)	1.7 (mg/day)	2.0−3.0 (6.0*)
Folic acid (µg /kg/day)	50 (µg /day)	23−100
Vitamin A (µg RE/kg/day)	59	400–1000
Vitamin D (units/kg/day)	400	400−700 (<1000*)

***upper intakes that may occasionally be required in routine clinical practice under certain conditions – seek advice from neonatal dietitian**

FEEDING GUIDE

- Commence enteral feeds in preterm and sick babies as close to birth as possible (unless clinically contraindicated)

Buccal colostrum

- Provides benefits of colostrum to **all** sick and premature babies unable to breast feed orally
- Give to **all** babies admitted to NNU who are not receiving oral feeds unless maternal breast milk is contraindicated (see **Breastfeeding** guideline)
- Place 0.3 mL (0.15 mL per side) colostrum in buccal cavity by syringe/gloved finger at 3-hrly intervals for first 48 hr of life
- Parental involvement in administration recommended. Nursing staff may teach and supervise parents to give colostrum

ENTERAL FEEDS

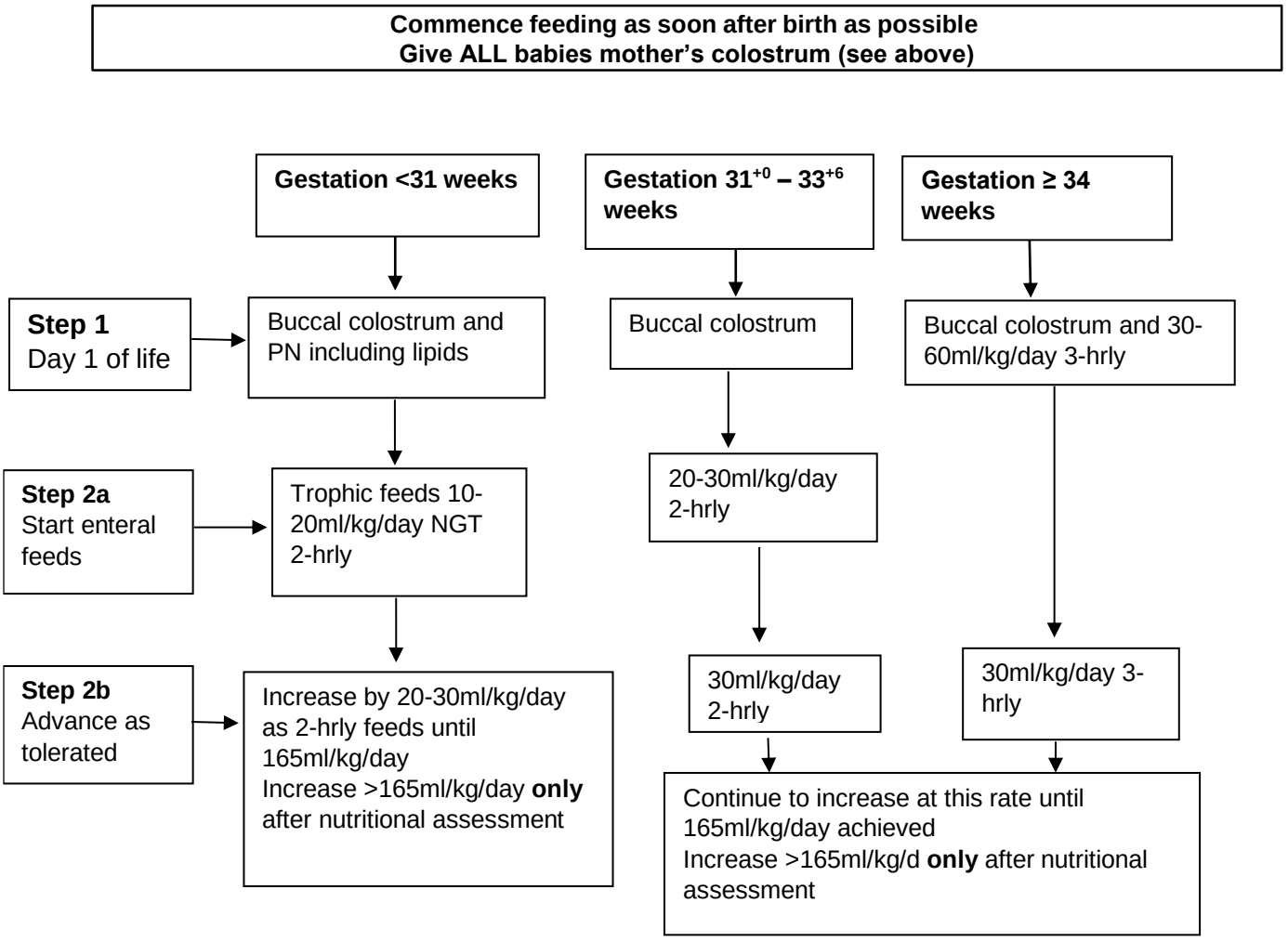
Route of administration

- Most babies <34 weeks are unable to co-ordinate sucking, swallowing and breathing to feed effectively and so should be fed via a naso- or orogastric tube
- Some babies <34 weeks may show feeding cues, especially while in skin-to-skin. They may be offered the breast, but bottle feeds should not be offered until >34 weeks (see **Progression to oral feeding in preterm babies** guideline)

Initiating and advancing enteral feeds

Make every effort to use mother's fresh expressed colostrum and breast milk

Flowchart 1: Initiating and advancing feeds



- If maternal breast milk (MBM) not available within 48 hr of birth, use donor breast milk (DBM), if criteria met, or preterm formula
- If unable to advance enteral feeds in first 3−7days:
- maintain trophic feeds small volumes (10–20 mL/kg/day) intended to stimulate gut trophic hormones
- contact neonatal dietitian
- In babies >31^{+0} review need for parenteral nutrition (see **Parenteral nutrition** guideline)

PROBIOTICS

- Reduce rates of NEC, sepsis, and mortality in babies born <32 weeks' gestation
- Insufficient evidence currently to recommend one product over another
- Give to all babies born <32 weeks' gestation when receiving 20 mL/kg/day enteral feeds
- if baby has stoma, when receiving 50 mL/kg/day enteral feeds
- If enteral feeds stopped, discontinue and restart when baby receiving enteral feeds 20 mL/kg/day
- Stop when baby reaches 34 weeks' CGA
- Provide parents with WMNODN leaflet on potential benefits and risks of probiotic administration

WHICH MILK TO USE

Maternal breast milk (MBM)

- Remains the ideal milk for term and preterm babies
- Support mothers to initiate and maintain expressing (see **Breastfeeding** guideline)
- Wherever possible, use MBM for initiation of enteral feeds. If milk supply insufficient for requirements it may not always be possible to follow feeding schedules until sufficient breast milk is available
- record absence of MBM as 'no maternal milk available' (NMMA)
- if insufficient MBM at 48 hr of life to meet requirements, give all available MBM and use appropriate alternative milks to commence or advance feeds

Donor breast milk (DBM)

- DBM should be offered to all babies <32 weeks or <1500 g to establish enteral feeds when MBM is unavailable or insufficient to meet baby's requirements
- DBM may also be offered for the short-term support of any baby on NNU whose mother is seeking to establish breast milk supply
- Essential to add breast milk fortifier (BMF) to DBM to meet nutrient requirements for preterm babies when volume intakes reach 100 mL/kg/day, then advance to 165 mL/kg/day as tolerated
- DBM use is generally restricted to establishing enteral feeds only
- Fortified DBM use can be prolonged for ELBW babies (<1000 g) where there is continued shortfall in MBM, with close monitoring of all growth parameters. Introducing alternative feeds when baby reaches 1000 g or shows suboptimal growth
- Once full volumes achieved (165 mL/kg/day) and baby aged ≥14 days introduce suitable alternative feed based on nutritional requirements (see **Slow change to a different type of milk feed**)
- Consent for DBM use must be obtained from parents

Breast milk fortifier

- Required by **all** babies born <34 weeks and/or <1.8 kg fed exclusively on M/DBM to meet protein and micronutrient requirements for growth
- Add BMF when M/DBM volumes reach 100 mL/kg/day
- Increase volume of M/DBM + BMF to maintenance full feeds of 165 mL/kg/day
- Use at full strength in M/DBM
- BMF use should continue until term age

Table 3

SMA BMF	1 sachet BMF added to 25 mL M/DBM

- Prepare as per manufacturer's instructions:
- add BMF as close to feed time as possible
- **swirl** breast milk gently to dissolve BMF to protect fragile cellular components in breast milk
- Feed **immediately** or store in fridge until required and use within 12 hr of preparation
- If baby receiving >50% requirements as preterm formula, stop BMF – unless advised to continue by neonatal dietitian

Table 4: Composition of mother's own breast milk, and fortified breast milk/100 mL

	Mature breast milk (>2 wk)	Fortified mature breast milk (Nutriprem HMF) (2021 data card)	Fortified mature breast milk (SMA PRO BMF) (2020 data card)
Energy (kcal)	69	86	86.2
Protein (g)	1.3	2.6	2.74
CHO(g)	7.2	8.7	8.5
Fat (g)	4.1	4.8	4.82
Sodium (mmol)	0.7	2.9	2.35
Calcium (mmol)	0.55	2.3	2.75
Phosphorus (mmol)	0.5	1.8	1.9
Vitamin A (µg)	57	289	438
Vitamin D (iU)	2	221	<160
Iron (mg)	0.07	0.07	1.87

- Use of BMF post discharge is recommended in babies:
  - discharged <term age and/or <1.8 kg
  - establishing oral breast feeding
  - showing slow growth velocity
- See for guidance on use of fortifier supplements for babies establishing oral feeds. All babies should be weaned off fortifier supplements by 6 weeks post-term

Table 5: Preparation and administration of fortifier supplements

		Fortifier supplements in breast fed
SMA BMF	2 sachets BMF added to 3 mL MEBM	Giv

Protein supplement (Nutriprem protein supplement)

- Use only under direction of neonatal/paediatric dietitian
- Provides extra protein to meet requirements of babies <1000 g
- Indicated if energy and protein intake are below requirements
- Extensively hydrolysed protein alone − **NO** micronutrients or energy
- Add to M/DBM alongside BMF or direct to preterm formula
- 1 g sachet = 0.82 g protein
- If blood urea in normal range do not add protein supplement discuss with neonatal/paediatric dietitian
- Monitor blood urea twice weekly in all babies on protein supplement
- **Stop** protein supplement when urea level >6 or when baby reaches 1000 g

Preterm milk formula

- **Nutriprem 1/SMA Gold Prem 1**: formulated to meet the nutrient needs of preterm babies born <34 weeks or <1.8 kg where insufficient MBM to meet requirements
- **Nutriprem 2/SMA Gold Prem 2**: nutrient enriched post-discharge formula (NEPDF) formulated to meet the ongoing enhanced nutrient needs of babies born <34 weeks, once beyond term age
- Babies with normal growth velocity and no requirement for catch-up growth may be discharged on term formula with appropriate vitamin and mineral supplementation
- NEPDF especially useful for babies who have higher nutritional requirements (e.g. CLD on oxygen) or babies who have ongoing poor growth (e.g. have crossed down >2 centiles on growth chart during neonatal stay)
- Volumes >165 mL/kg are not usually necessary and other reasons for poor growth should be sought before further volume increases introduced (see **Inadequate growth**)

Specialised preterm formula (Hydrolysed Nutriprem 1)

- **Always** use under direction of paediatric/neonatal dietitian
- Hydrolysed Nutriprem 1 – extensively hydrolysed protein preterm formula
  - may be suitable for babies who fail to tolerate/progress on standard preterm formula or have a family history of CMPI (**NOTE** contains lactose)

Table 6: Composition of preterm formula/100 mL

	Nutriprem 1 (2020 data card)	Hydrolysed Nutriprem 1 (2020 data card)	SMA Gold Prem 1 (2020 data card)
Recommended volumes mL/kg/day	150–180	150–180	150
Energy (kcal)	80	80	80
Protein (g)	2.7 (whole protein)	2.6 (partially hydrolysed)	2.9 (partially hydrolysed)
CHO (g)	8.4 (55% lactose)	8.4 (46% lactose)	8.1 (45% lactose)
Fat (g)	3.9 (8% MCT)	4 (7% MCT)	4 (12.5% MCT)
Sodium (mmol)	3	3.3	2.4
Calcium (mmol)	2.5	2.4	3.0
Phosphorus (mmol)	2.0	1.75	2.5
Vitamin A (µg RE)	366	366	330
Vitamin D (µg)	3.1	3.1	3.4

All 'specialised' term formulas

- **Do not** provide adequate nutrition for preterm babies at standard dilution so require modification to ensure nutritional requirements met. Use only when clinically indicated and always under direction of paediatric/neonatal dietitian

Table 7: Maintenance feeds for neonates based on gestational age and/or weight

Gestational age and/or weight	Maintenance feed
<32 weeks **and/or** <1000 g	• M/DBM + BMF: 165 mL/kg/day • Nutriprem 1: 165 mL/kg/day
Born between or on reaching $32+^{0}$–33^{+6} weeks	• MBM + BMF: 165 mL/kg/day • Nutriprem 1: 165 mL/kg/day
On reaching 34 weeks	• MBM + BMF: 165 mL/kg/day • Nutriprem 1: 165 mL/kg/day • Introduce oral feeds (see **Progression to oral feeding** guideline) • Introduce fortifier supplements as breastfeeding increases (see **Breast milk fortifier**)
Preterm babies (born <34 weeks) at discharge or term age (whichever is earliest)	**<36^{+6} weeks** • **Breast milk feeding** • modified responsive breast feeding with fortifier supplements (see BMF section) • Expressed MBM + BMF: 165 mL/kg/day • **Formula feeding:** • **<1.8 kg:** − Nutriprem 1: 165 mL/kg/day • **≥1.8 kg:** − NEDPF (Nutriprem 2): 165 mL/kg/day
	≥37 weeks • **Normal growth velocity and no requirement for catch-up growth:** • allow natural reduction in BMF as breastfeeding increases, transition to responsive breastfeeding • if insufficient MBM/parents choose to formula/mix feed use term formula • **Poor growth velocity and catch-up growth required:** • **breast milk feeding** − modified responsive breast feeding with fortifier supplements (see BMF section) • **Expressed MBM + BMF: 165 mL/kg/day** • **formula feeding** − NEDPF (Nutriprem 2): 165 mL/kg/day
Born between 34–37 weeks **and** <1.8 kg	• MEBM and BMF: 165−180 mL/kg/day • modified responsive breastfeeding with fortifier supplements (see **Breast milk feeding** section) • NEPDF (Nutriprem 2)165 mL/kg/day modified responsive bottle feeding (see **Bottle feeding in the neonatal unit** guideline)
Born ≥34 weeks and ≥1.8 kg	• Modified responsive breastfeeding or MEBM 180 mL/kg/day via NGT/OGT (see **Breastfeeding** guideline) • Term formula 165–180 mL/kg/day via NGT/OGT or modified responsive bottle feeding (see **Bottle feeding in the neonatal unit** guideline)

Change to different type of milk feed

- Done slowly to ensure baby tolerates change
- **Day 1**: 75% feeds with current milk, 25% with new milk (i.e. 3 old feeds:1 new feed)
- **Day 2**: 50% feeds with current milk, 50% with new milk (i.e. 2 old feeds:2 new feeds)
- **Day 3**: 75% feeds with new milk, 25% with current milk (i.e. 1 old feed:3 new feeds)
- **Day 4**: 100% new milk
- It is acceptable to mix the milks together

Do not add HMF/BMF to formula – omit during slow change if feeds being mixed

VITAMIN SUPPLEMENTATION

- Start enteral vitamin supplements when babies reach 100 mL/kg/day enteral feeds
- For babies transitioning from PN start enteral vitamins when on 100ml/kg/d of enteral feeds (see PN guideline – Lipid section)
- Continue vitamin doses until aged 6 months corrected age – then follow Department of Health baby vitamin supplementation guidelines

Department of Health Guidelines state all children aged 6 months–5 yr receive vitamin supplementation containing vitamins A C D unless receiving formula milk >500 mL/day. Exclusively breastfed babies should receive vitamin D supplementation from birth

Table 8

	Current weight	ABIDEC	Folic Acid
Babies born <34 weeks and /or <1.8 kg			
Fortified MEBM/DEBM Preterm Formula (Nutriprem 1)	≤1 kg	0.3 mL once daily	X
	>1 kg	0.6 mL once daily	X
***Unfortified MBM/DBM**	≤1 kg	0.6 mL once daily	50 micrograms once daily
	>1 kg	0.6 mL once daily and Vitamin D Colecalciferol 600 units **alternate days**	50 micrograms once daily
	ABIDEC		**Folic Acid**
Babies born <34 weeks' gestation when reaching ≥1.8 kg			
Post discharge formula (Nutriprem 2) MBM and post-discharge fortifier High energy infant formula (Infatrini/SMA high energy)	0.3 mL once daily		X
Unfortified MBM Term formula	0.6 mL once daily		X

*Preterm babies fed exclusively on unfortified breast milk will not meet recommended intakes for calcium / phosphate and other essential micronutrients. Care needs to be taken to ensure risk of deficiency of micronutrients is minimised, especially the impact on metabolic bone disease see **Metabolic bone disease** guideline for advice on screening and supplementation

† **NOTE** doses of Abidec® and Dalivit ® are not equivalent due to differing levels of vitamin content, especially vitamin A. In the absence of ABIDEC consider using Healthy Start Vitamins as next best alternative or seek advice of neonatal dietitian/pharmacist (see **Table** below)

Table 9: Multivitamin supplements

	Abidec 0.6 mL	Dalivit 0.6 mL	Healthy start children's vitamin 5 drops
Vitamin A (units)	1333	5000	776
Vitamin D (units)	400	400	400
Vitamin C (mg)	40	50	20
Thiamine B1 (mg)	0.4	1	X
Riboflavin B2 (mg)	0.8	0.4	X
Pyridoxine B6 (mg)	0.8	0.5	X
Nicotinamide B3 (mg)	8	5	X

IRON SUPPLEMENTATION

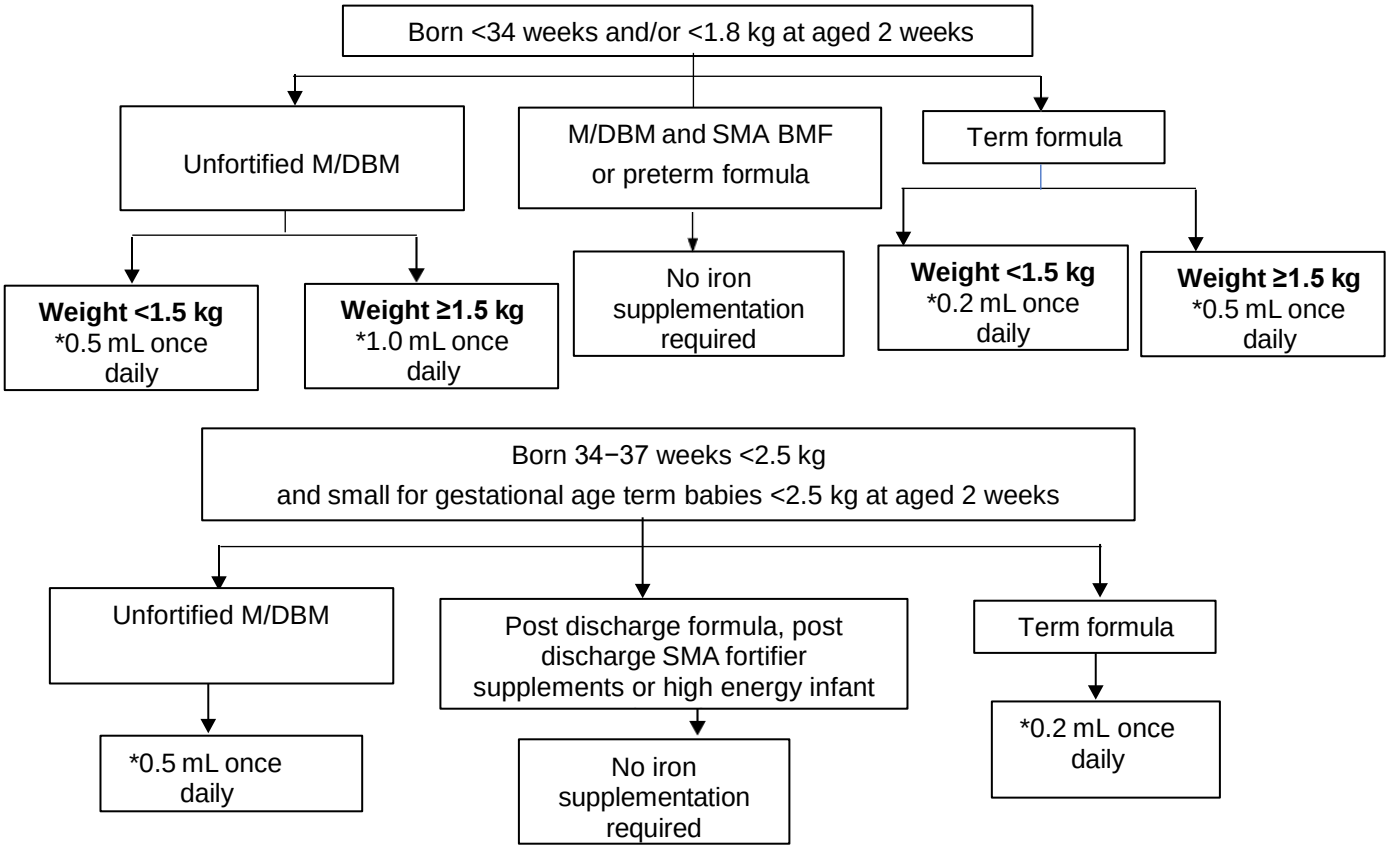
- Only required where milk feed does not contain enhanced iron levels to meet recommended intakes – see **Flowchart 2**
- Start iron supplementation from aged 2 weeks and tolerating 100 mL/kg/day enteral feeds
- **note:** in babies **not** tolerating 100 mL/kg/day enteral feeds at aged 2 weeks discuss administration of iron supplements with neonatal dietitian or pharmacist
- Using *sodium feredetate (27.5 mg iron per 5 mL)
- Recommended iron intakes − see **Table 10**

Table 10

Baby	
Preterm <34 weeks	
≥34−<37 weeks	
Term baby ≥37 weeks	

- Continue iron supplements until aged 12months corrected age

Flowchart 2
Iron supplementation to meet recommended intakes



FEED TOLERANCE EVALUATION

Monitoring of feed tolerance, growth and biochemical balance is critical in nutritional management of preterm babies to ensure optimal outcomes

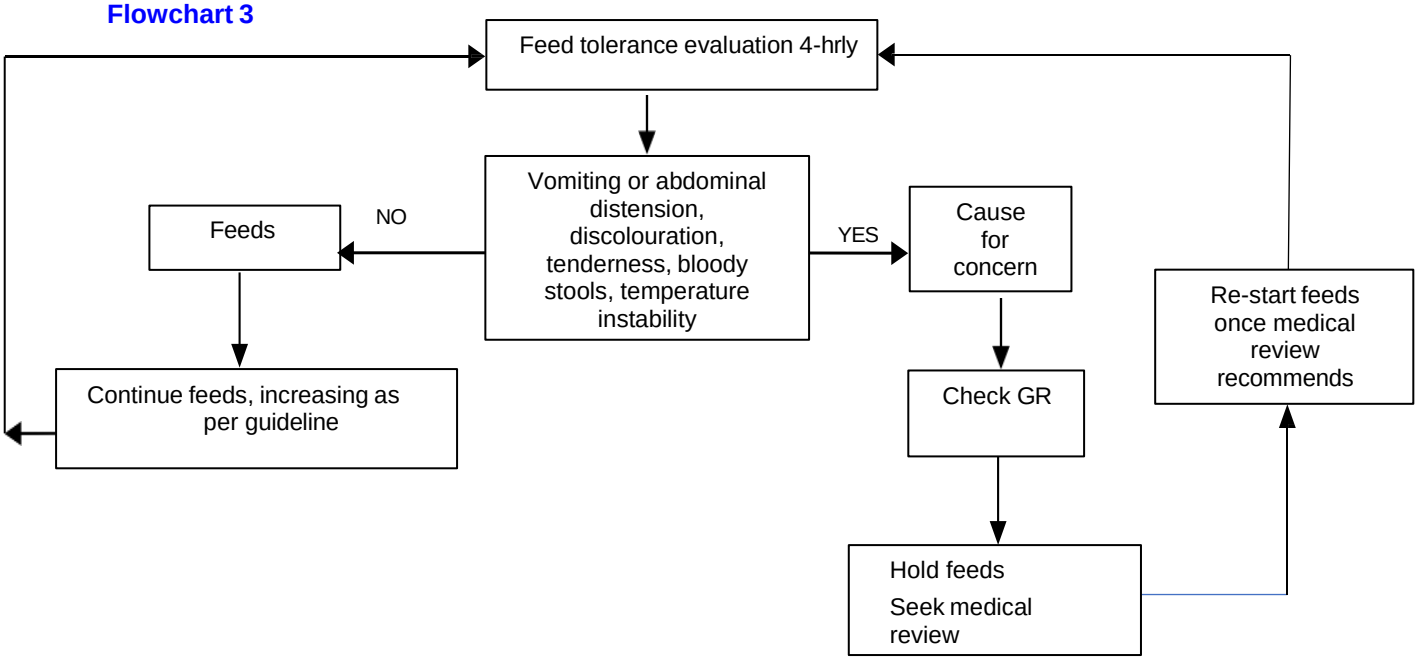
Feed tolerance

- Poor gut motility is common among VLBW/ELBW babies, and some will have episodes requiring temporary discontinuation of feeding or delay in advancing feeds
- If failure to progress feeds continues over several days, seek advice early from neonatal/paediatric dietitian

Assessment of gastric residuals (GR)

- Evaluate feed tolerance 4-hrly (see **Flowchart 3**)
- Routine aspiration of GR not recommended in preterm babies
- Do not use GR volumes in isolation when deciding to limit advancement of feeds

Flowchart 3



Anthropometry

- See **Growth monitoring** guideline

Biochemical monitoring

- Measure plasma urea, electrolytes, ALP, calcium, and phosphate weekly in stable preterm babies
- Monitor glucose closely in initial few days

INADEQUATE GROWTH VELOCITY

- Preterm babies with sub-optimal growth velocity require further assessment
- Review proportional growth (weight, head, length) on age and gender appropriate growth chart
- Ensure baby **prescribed** and **receiving** recommended nutritional intake. Ensure on maximum advised volume of age/weight appropriate feed – see maintenance feed volume/type charts
- Review energy and protein intake per kg/day against ESPGHAN recommendations for weight/gestational age
- Measure urine sodium concentration. Value <20 mmol/L indicates sodium depletion (not valid if baby on diuretics)
- If sodium supplements required:
  - check urine sodium weekly
  - keep **total enteral** sodium intake (feed + standard supplement + prescribed supplement) < 8 mmol/kg/day
- In babies receiving MBM use hind milk (see **Breast milk expression** guideline)
- Check zinc level in cases of poor growth associated low ALP, especially in surgical babies where excess GI losses are possible and supplement if low
- Refer to neonatal/paediatric dietitian for assessment and advice
- Do not advance feed volumes beyond that recommended unless on advice of dietitian

- **Formula fed >37 weeks, ≥2 kg:**
  - replace 25–50% MEBM/NEPDF with high energy term formula (Infatrini, SMA High Energy, Similac® High Energy) and refer to paediatric/neonatal dietitian for follow-up
- **Breast milk fed >37 weeks:**
  - stop BMF in MBM but continue with concentrated BMF supplements as detailed in **Breast milk fortifier** section

Department of Health Guidelines state all children aged 6 months–5 yr receive vitamin supplementation containing vitamins A C D unless receiving formula milk >500 mL/day Exclusively breastfed babies should receive vitamin D supplementation from birth