NUTRITION AND ENTERAL FEEDING

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

PRINCIPLES
- 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 PN, dysbiosis of the intestine, poor organ growth and poorer neurological function
- Manage feeding on an individual basis dependent upon gastrointestinal tolerance and availability of breast milk
- There is robust evidence that feeding maternal colostrum & breast milk is protective for necrotising enterocolitis (NEC), sepsis & retinopathy when compared to formula milk

NUTRITIONAL REQUIREMENTS
Daily recommended intake of nutrients for stable/growing preterm babies

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Term baby</th>
<th>Preterm baby (ESPGHAN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal/kg)</td>
<td>95–115</td>
<td>110-135</td>
</tr>
<tr>
<td>Protein (g/kg)</td>
<td>2</td>
<td>&lt;1Kg 4-4.5 1-1.8kg 3.5-4</td>
</tr>
<tr>
<td>Sodium (mmol/kg)</td>
<td>1.5</td>
<td>3–5</td>
</tr>
<tr>
<td>Potassium (mmol/kg)</td>
<td>3.4</td>
<td>2–3</td>
</tr>
<tr>
<td>Calcium (mmol/kg)</td>
<td>3.8</td>
<td>2.5–5.5</td>
</tr>
<tr>
<td>Phosphate (mmol/kg)</td>
<td>2.1</td>
<td>2–4.5</td>
</tr>
<tr>
<td>Vitamin A (ug RE/kg)</td>
<td>59</td>
<td>400–1000</td>
</tr>
<tr>
<td>Vitamin D (ug/d)</td>
<td>8.5</td>
<td>10–25</td>
</tr>
</tbody>
</table>
**FEEDING GUIDE**

**Route of administration**
- Babies <34 weeks cannot co-ordinate sucking, swallowing and breathing effectively and must be tube fed
- Use gastric feeding with either nasogastric (NGT) or orogastric (OGT) tube
- Encourage early expressing in all mothers within 2 hours of delivery & give buccal colostrum as soon as available and continue to give 3 hourly for first 48 hours of life.

**Initiating and advancing enteral feeds**
Make every effort to use mother’s fresh expressed colostrum and breast milk.

<table>
<thead>
<tr>
<th>Gestation ≤30 wks +/- or ≤1000g</th>
<th>Gestation 30+1-33+6 wks +/- or &gt; 1kg - 2kg</th>
<th>Gestation ≥34 wks +/- or &gt; 2kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commence feeding as soon after birth as possible ALL infants should receive mum’s own colostrum 0.3ml 3 hourly BUCCALLY for a maximum of 48hours after birth unless clinically indicated to be NBM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start PN inc lipids</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start 10–20 mL/kg/day tube feeds 2 hrly Increase by 30 mL/kg/d as 2 hourly feeds until 180 mL/kg/d is reached Only increase beyond 180 mL/kg after growth assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start 20–30 mL/kg/day 2 hrly tube feeds Increase by 30 mL/kg/d as 2 hrly feeds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start 30–60 mL/kg/day 3-hrly feeds Increase by 30 mL/kg/day as 3-hrly feeds Continue to increase at this rate until 180 mL/kg/d is achieved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NB:** If no MEBM available by 48 hours after delivery start DEBM or preterm formula at trophic level whilst waiting for MEBM or advance as per protocol if insufficient MEBM available.

**Which milk to use**
*Mother’s expressed breast milk (MEBM)*
- Wherever possible, use mother’s expressed breast milk for initiation of enteral feeds. Breast milk remains the ideal milk for term and preterm babies and should be strongly recommended.
- Breast milk is more protective against NEC than formula milk.
- If decision to breastfeed/use MEBM is made when starting feeds, use breast milk enterally as available. It may not be possible to follow schedules below until sufficient breast milk is being produced. Record insufficient breast milk supply as **NMMA = No Mother’s Milk Available**.
- To meet enteral feed requirements in the absence of sufficient MEBM DEBM (if available) or Formula can be used to supplement maternal supply.

**Donor expressed breast milk (DEBM)**
- In the absence of a mother’s own expressed breast milk, use donor milk if available as the next milk of choice for babies ≤30 weeks or ≤1000g.
- Due to the poor nutritional profile of donor milk it is wise to restrict use to establishing enteral feeds up to a minimum volume of 150ml/kg/d.
  - Commence a gradual introduction of alternative feeds to provide ongoing adequate nutritional intake (see **Slow change to a different type of milk feed**).

**Breast milk fortifier (BMF) (Nutriprem HMF/SMA Pro BMF)**
- All preterm infants born <33+6 weeks fed on D/MEBM require addition of BMF to meet protein requirements as recommended by ESPGHAN 2010.
- When MEBM/DEBM tolerated at 150 mL/kg for 24 hr and >7 days old, add HMF/BMF.
- Gradually increase volume of milk to full feeds of 180–200 mL/kg/day.
- If growth and oral feeding adequate stop BMF at 2kg, in growth insufficient continue BMF at half dose – see section feeding infants >2kg.

### Nutrient composition of mother’s own breast milk/donor milk//fortified breast milk per 100 mL

<table>
<thead>
<tr>
<th></th>
<th>Preterm breast milk</th>
<th>Mature breast milk (&gt;2 wk)</th>
<th>Donor EBM</th>
<th>Fortified mature breast milk (Nutriprem HMF)</th>
<th>Fortified mature breast milk (SMA BMF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>70</td>
<td>69</td>
<td>66</td>
<td>85</td>
<td>86.2</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>1.8</td>
<td>1.3</td>
<td>0.9</td>
<td>2.6</td>
<td>2.74</td>
</tr>
<tr>
<td>Sodium (mmol)</td>
<td>1.3</td>
<td>0.7</td>
<td>Not specified</td>
<td>2.2</td>
<td>2.35</td>
</tr>
<tr>
<td>Calcium (mmol)</td>
<td>0.55</td>
<td>0.55</td>
<td>Not specified</td>
<td>2.2</td>
<td>2.75</td>
</tr>
<tr>
<td>Phosphorus (mmol)</td>
<td>0.5</td>
<td>0.5</td>
<td>Not specified</td>
<td>1.9</td>
<td>1.9</td>
</tr>
<tr>
<td>Vitamin A (ug)</td>
<td>83</td>
<td>57</td>
<td>Not specified</td>
<td>289</td>
<td>438</td>
</tr>
<tr>
<td>Vitamin D (ug)</td>
<td>0.18</td>
<td>0.05</td>
<td>Not specified</td>
<td>5.5</td>
<td>≥4</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.09</td>
<td>0.07</td>
<td>Not specified</td>
<td>0.07</td>
<td>2.07</td>
</tr>
</tbody>
</table>

### Protein supplement (Nutriprem Protein Supplement)
- **ONLY** use under direction of neonatal or paediatric dietitian.
- Formulated to provide extra protein to meet the requirements of infants <1000g only
- Extensively hydrolysed protein alone – NO micronutrients or energy
- Calculate energy and protein intake and compare to requirements prior to addition of protein supplement
- Check blood urea if normal ranges do not add protein supplement – discuss with neonatal or paediatric dietitian
- Add to D/MEBM alongside BMF or directly to preterm formula to enhance protein intake - 1g sachet = 0.82 g protein to be added per 100ml
- Monitor blood urea nitrogen twice weekly in all infants on protein supplement.
- Stop protein supplement when urea levels above 6

Preterm milk formula
- Indicated for babies born <2000 g and <34 weeks’ gestation
- Nutriprem 1 indicated for infants <2kg,
- Nutriprem 2 indicated for infants > 2kg

Specialised preterm formulas (Hydrolysed Nutriprem 1/SMA Pro Gold Prem 1)
Always use under the direction of a paediatric or neonatal dietitian
- Hydrolysed Nutriprem 1 – partially hydrolysed whey, extensively hydrolysed casein protein preterm formula
- SMA Pro Gold Prem 1 – partially hydrolysed whey protein, MCT containing preterm formula (indicated especially babies <1000 g)
- These formulas may be suitable for babies who fail to tolerate/progress on standard preterm formula, OR have a family history of CMPI (Hydrolysed Nutriprem 1 only), OR require MCT for proven fat malabsorption (SMA Pro Gold Prem 1 only),

<table>
<thead>
<tr>
<th></th>
<th>Nutriprem 1</th>
<th>Hydrolysed Nutriprem 1</th>
<th>SMA Gold Prem 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kcal)</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>2.6 (whole protein)</td>
<td>2.6 (partially hydrolysed)</td>
<td>2.9 (partially hydrolysed)</td>
</tr>
<tr>
<td>CHO (g)</td>
<td>8.4 (55% lactose)</td>
<td>8.4 (46% lactose)</td>
<td>8.1 (45% Lactose)</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>3.9 (15% MCT)</td>
<td>4 (15% MCT)</td>
<td>4 (40% MCT)</td>
</tr>
<tr>
<td>Sodium (mmol)</td>
<td>3.18</td>
<td>3.18</td>
<td>2.3</td>
</tr>
<tr>
<td>Calcium (mmol)</td>
<td>2.4</td>
<td>2.4</td>
<td>2.9</td>
</tr>
<tr>
<td>Phosphorus (mmol)</td>
<td>2.0</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Vitamin A (ug RE)</td>
<td>361</td>
<td>361</td>
<td>370</td>
</tr>
<tr>
<td>Vitamin D (ug)</td>
<td>3</td>
<td>3.0</td>
<td>3.7</td>
</tr>
</tbody>
</table>

(based on 2014 datacards)

All ‘specialised’ term formulas
- These formulas do not provide adequate nutrition for preterm babies at standard dilution and will require modification to ensure individual requirements are met. Use specialised formulas only where absolutely
necessary and always under the direction of a paediatric or neonatal dietitian

SWMMNN Appropriate Maintenance Feeds for Neonates based on gestational age +/-or weight

**KEY:**
- Red: If MEBM available
- Blue: If NO MEBM available

### Gestational Age/Weight

- **<29 weeks &/or <1000g**
  - MEBM + BMF aim 180ml-200ml/kg/d
  - DEBM + BMF aim 180-200ml/kg/d
  - Nutriprem 1 aim 160-180ml/kg/d

- **29+1 – 33+6 weeks &/or 1 to 2kg**
  - MEBM + BMF aim 180ml-200ml/kg/d
  - Nutriprem 1 aim 160-180ml/kg/d

- **Inpatients Born At or On Reaching 34weeks &/or 1 to 2kg**
  - MEBM + BMF aim minimum 160-180ml/kg/d
  - Nutriprem 1 aim 160-180ml/kg/d
  - Introduce oral feeds & establish breast or bottle feeding
  - Continue BMF in any MEBM given

- **On Reaching 34weeks & greater than 2kg or At Discharge less than 2kg**
  - MEBM (stop BMF) aim minimum 160-180ml/kg/d - may increase further
  - Nutriprem 2 aim 160-180ml/kg/d
  - Introduce oral feeds & establish breast or bottle feeding – see Progression To Oral Feeds

- **Born >34 weeks & greater than 2kg or Term infant**
  - MEBM minimum 160-180ml/kg/d or Breast Feeding on demand
  - Term Formula 150-180ml/kg/d or on demand

### Slow change to different type of milk feed
- To slowly change from one type of milk feed to another to ensure baby tolerates the change in feed
- **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 also acceptable practice during the slow change to mix the milks together rather than using separately (NB: HMF/BMF should not be added to formula so omit during slow change if feeds are being mixed)

Produced for SWMNN by Sara Clarke, Senior Specialist Neonatal Dietitian May 2017
Guidance for Iron and Vitamin Supplementation

All Infants born at <34 Weeks Gestation
And/or <1500g
AND

At least 7 days old and when tolerating 50% enteral feeds

Unfortified Breast Milk or
Term Formula

Fortified Breast Milk

Preterm Formula

Abidec (or Dalivit) 0.6mls od

**Joulies Phosphate
0.5mmol/kg tds if <30 weeks
or ≤1500g at birth

<2kg 0.3ml Abidec od
≥2kg no vits required

**No routine Joulies Phosphate

Abidec 0.3mls od

No routine Joulies Phosphate

At 28 Days of Age

Sodium feredetate
(Sytron)

<1.5kg 0.5ml od
≥1.5 kg 1ml od

No Iron Supplementation

At Discharge

Sodium feredetate
(Sytron)

<1.5kg 0.5ml od
≥1.5 kg 1ml od

Post Discharge Formula
or MEBM + BMF or
BMF supplements

Abidec (or Dalivit) 0.6mls od
Sodium feredetate (Sytron) 1ml od

Abidec 0.3mls od (but NOT Dalivit in view of high Vit A)
No iron supplementation

**Regardless type of feed baby receiving; if ≥33+6 weeks gestation at birth with PO4 <1.8mmol or >34 weeks gestation with PO4 <1.4mmol, a paired urine and blood phosphate should be sent to measure Tubular Reabsorption of Phosphate (TRP). If >95% start PO4 supplementation. Alk phos not sensitive or specific with regards to oesteopaenia of prematurity.
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 to be expected among V/ELBW babies
- Seek advice early from a neonatal or paediatric dietitian if failure to progress feeds continues over several days

Assessment of Gastric Residuals (GR)

Anthropometry
SEE WEIGHING AND MEASURING GUIDELINE for details
- Monitor weight daily for first few days to assist with fluid management – see Intravenous fluid therapy guideline
- once clinically stable, measure weight NICU/HDU X 3 per week
- SCBU x 2 per week

Produced for SWMNN by Sara Clarke, Senior Specialist Neonatal Dietitian May 2017
- Calculate growth as Kg/day to ensure adequate velocity
- Aim weight gain of 15–20 g/kg/day in infants <2kg
  - 25–30 g/day is adequate weight gain in infants >2.0 kg
- Measure head circumference weekly. Velocity = 0.9 cm/week

- Measure length on admission and then weekly. Velocity = 1.4 cm/week
- Document & PLOT weight, length and head circumference weekly on RCPCH-WHO Neonatal & close monitoring growth chart

### Biochemical monitoring
- Measure plasma urea, electrolytes, calcium, phosphate and albumin weekly in stable preterm infants to monitor nutritional status.
- Monitor glucose closely in initial few days

### Inadequate growth
- Preterm infants with weight gain <15 g/kg/day require further assessment
- Review proportional growth – weight, head, length on growth chart
- Ensure baby receiving adequate nutritional intake Calculate energy and protein intake per kg/day and compare with ESPGHAN recommended requirements for weight/gestational age.
- Ensure on maximum advised volume of age/weight appropriate feed – see maintenance feed volume/type charts

Check adequate total body sodium by ensuring sodium excretion in the urine of at least: urine sodium >20 mmol/L. (only useful in infants NOT receiving diuretics). Add extra supplements as necessary
- In infants receiving MEBM use hind milk (see Hind Milk Policy)
- Increase feed volumes, if tolerated, beyond that recommended
  - Up to 220 ml/kg/d if receiving MEBM + BMF,
  - Up to 200 ml/kg/d if receiving preterm formula
- For infants receiving MEBM + BMF who don’t tolerate increased volumes or where there is insufficient MEBM to increase volumes – replace 25–50% MEBM + BMF with gestational age/weight appropriate formula <2kg preterm formula, >2kg High Energy Term Formula
- DO NOT mix formula feeds with D/MEB + BMF.
- Refer to neonatal or paediatric dietitian for assessment and advice

### PROGRESSION TO ORAL FEEDING

**Aim**
Safe progression to oral feeding – see Progression to Oral Feeding Guideline

- **Feeding infants over 2kg**
  **Vitamins & Iron**
  - All infants born <34 weeks’ gestation and/or <1500 g, prescribe multivitamins and discontinue once mixed feeding established
  - Exclusive breast feeding (Abidec) 0.6 mL od + iron (Sytron) 1 ml od
  - Post discharge preterm formula (Abidec) 0.3 mL odl
- Term formula (Abidec) 0.6ml od + iron (Sytron) 1ml od
- High Energy Infant Formula (Abidec) 0.3ml od

- **Exclusive Breast Milk**
  Encourage modified responsive breast feeding / bottle feeding of MEBM

  Infants with poor nutritional progress:
  Bottle feeding MEBM: use half dose BMF added to feeds
  Exclusive breast feeding: use **half daily dose** BMF - give 1 sachet dissolved in 3ml MEBM via a teat before 4-5 breast feeds equally spread throughout 24 hours (NO more than 5 sachets/day)
  Continue BMF until 6 weeks post term or 3.5kg whichever is the soonest.

- **Exclusive or Partial Formula feeding**
  Babies born <34 weeks with suboptimal growth at discharge prescribe post discharge preterm formula (Nutriprem 2 / SMA Pro prem 2) until 6 months corrected gestational age or adequate catch up growth achieved. All infants over 2.5kg with good growth velocity consider term formula at discharge.

**Department of Health Guidelines state all children aged 6 month—5 yr receive vitamin supplementation unless receiving >500 mL/day formula milk**