

# Optimising Neonatal Nutrition: A guide for the use of enriched milk, vitamins and iron for babies

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# 1. Introduction and Who Guideline applies to:

This guideline is aimed at all Health Care Professionals involved in the nutritional care of babies admitted to the neonatal unit.

## Key Points

- Babies born preterm (< 34 + 0 weeks gestation) and / or small for gestational age (< 1.8kg) have increased energy and protein requirements when compared to babies born later than 34 + 1 and / or >1.8kg and as such, may require enriched milk.
- Breast milk is the feed of choice for all infants.

## Related guidelines;

[Use of Donor Breast Milk UHL Neonatal Guideline](#)  
[Skin to Skin \(Kangaroo Care\) UHL Neonatal Guideline](#)  
[Colostrum Collection – Antenatal UHL Obstetric Guideline](#)

## Background

Preterm babies born <34 weeks' gestation or <1.8kg have increased energy requirements as per the latest ESPGHAN position paper (Embleton et al, 2022). The aim is to meet these nutritional requirements to support growth and development based on in-utero growth (Embleton et al, 2022). Nutritional requirements for preterm babies remain high until around 40 weeks post term even for babies who are tracking appropriate centiles and growing in proportion to length and OFC.

Breast milk and term formula do not meet the raised nutritional requirements of the preterm baby, as such fortified or enriched milk should be used. Breast milk fortifier (BMF) provides additional protein, calcium, phosphate, vitamins and minerals to meet nutritional requirements of preterm babies with a birth weight <1.8kg (Agostoni et al, 2010). Nutrient enriched preterm formula has a greater energy, protein and micronutrient content, which has been shown to improve OFC and lean body mass post discharge whilst reducing fat mass in preterm babies (Roggero et al, 2012). Formula should only be used when breast milk is not available.

## **2. Guideline Standards and Procedures:**

### **2.1 Breast Milk**

Breastfeeding supports infants' immune systems and may protect them later in life from chronic conditions such as obesity and diabetes. Furthermore, it protects against NEC (Lucas et al, 2009; Sami et al, 2023), reduces stress and promotes growth and neurological development, immune function, gut adaptation and the microbiome. Mother's own milk is unequivocally the best medicine for baby. Any volume of breast milk given is beneficial.

We should encourage skin to skin contact as early and as often as possible once baby is clinically stable. Around 33-34 weeks' gestation, encourage breastfeeding at feeding time or whenever baby is rooting. Skin to skin and non-nutritive sucking allows the baby to practice and learn feeding skills required to breastfeed. We should also consider replacing the OGT with an NGT due to the impact of negative oral experience, which may inhibit tongue movement and feeding progress.

### **2.2 Expressed breast milk**

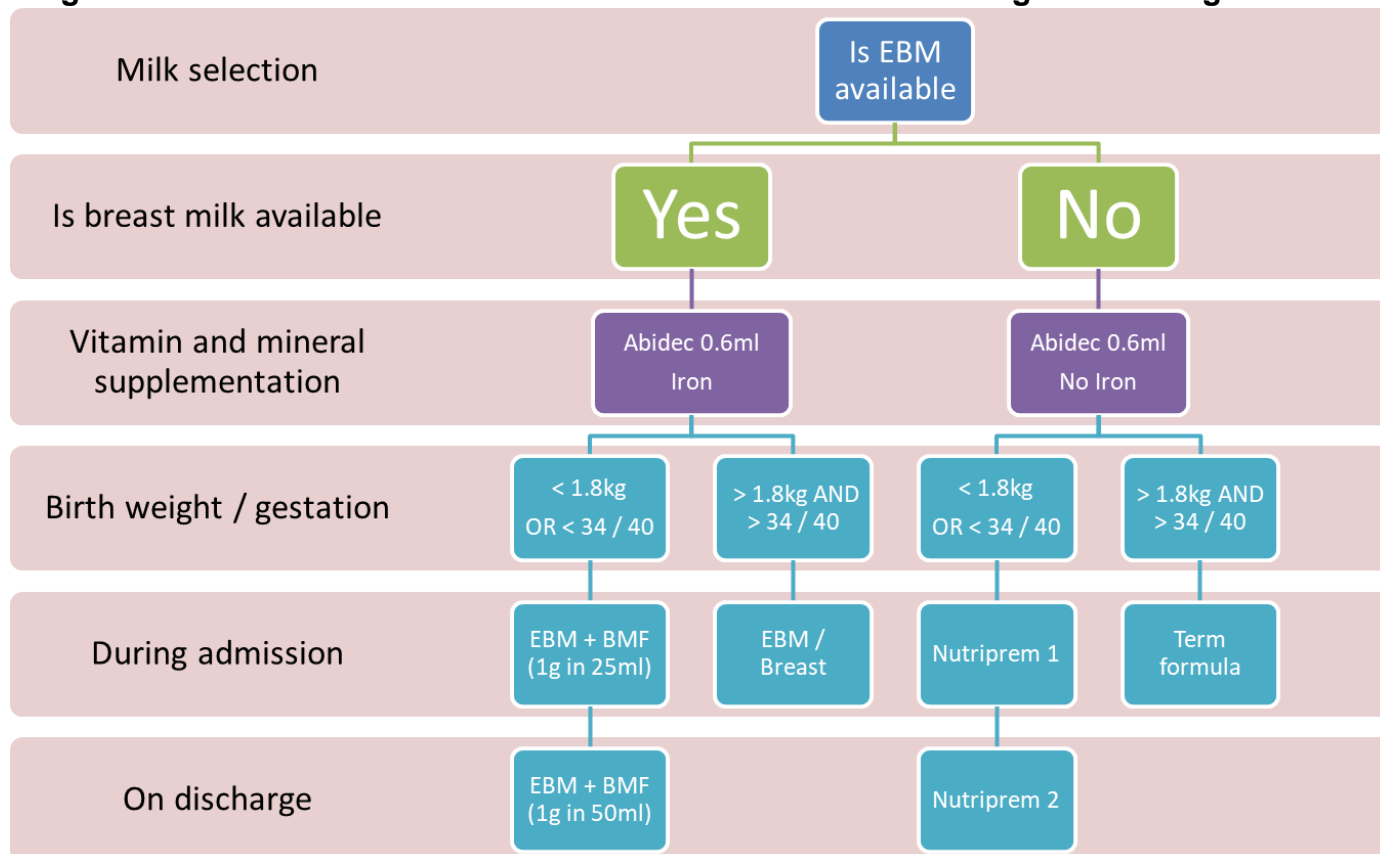
Mothers of preterm babies should be supported to express breast milk until their baby is ready to breast feed, which is usually after 34 weeks CGA.

Usually use fresh milk first, followed by milk from the freezer in date order. After a period of NBM for NEC, consider using colostrum or EBM expressed in the first 2 weeks of life due to high bioactive components which promote gut adaptation / priming when feeds are recommenced.

All babies should be given expressed breast milk (EBM) when breastfeeding is not appropriate. In babies born before 32 + 0 weeks gestation or < 1.5kg consider using donor expressed breast milk (DEBM) if EBM is not available for 2 weeks prior to commencing formula as per DEBM guideline.

Where mums expressed breast milk (EBM) supply is insufficient or delayed, donor expressed breast milk (DEBM) should be used in babies born <32/40 and for 2 weeks after full feeds reached before using formula. If maternal milk supply is low after giving DEBM, or mum is planning on stopping expressing, consider introducing 50% formula to extend length of time EBM is given. A sudden switch from DEBM/EBM to formula should be avoided in high-risk groups if possible and a gradual transition over 4 days done (see DEBM policy).

**Diagram 1: Choice of milk and vitamins on admission and discharge < 37 / 40 gestation**



\*Refer to EBM / DEBM guideline whilst establishing feeds of babies born <32/40 and <1.5kg.

## 2.3 Breast milk fortifier (BMF)

Babies born before 34 + 0 weeks gestation and / or birth weight <1.8kg should be prescribed breast milk fortifier (BMF) if receiving EBM / DEBM (if appropriate).

How to use BMF;

- Mix 1g BMF into 25ml EBM (80kcal and 2.9g protein / 100ml).
- BMF should be gently mixed (swirled) until dissolved into warm EBM or DEBM (approximately 37 degrees) and used within 2 hours.
- Spread doses evenly throughout the day whenever possible.

During admission;

- BMF should be used to fortify both EBM and DEBM from 120ml/kg/day.
- Whilst establishing breast feeds, continue to use BMF in bottles / NGT feeds (1g in 25ml EBM).
- Introduce boosters if weight gain starts to reduce in babies who establish breast feeding with < 50% bottle/ NGT top ups.

How to make a BMF booster;

- Mix 1g BMF sachet in 2-5ml EBM.

- Give 1 BMF sachet x 6 per day spread evenly throughout the day.
- Or combine into 3 BMF boosters if preferred (Mix 2 x 1g BMF sachet into 5-10ml EBM).

## 2.4 Formula

Babies born after 34 + 1 weeks gestation with a birth weight >1.8kg can be given standard formula where breast milk is not available. Refer to the dietitian for advice if there concerns regarding poor growth, feeding or nutritional intake.

Nutrient enriched formulas (e.g. Nutriprem 1)

Babies born at less than 34 + 0 weeks gestation and / or birth weight <1.8kg should be prescribed a nutrient enriched, low birth weight formula (e.g. Nutriprem 1) if there is insufficient EBM during admission.

For inpatient use only.

Nutrient enriched formula can be used alongside EBM to prolong use of frozen supplies where mum plans to or has to discontinue breast milk expression.

If mum has low supply but plans to continue expressing, use all available EBM as soon as possible after expression. Avoid storage of milk in the fridge and freezer wherever possible. Consider if DEBM guideline has already been followed for 2 weeks.

## 2.5 Iron:

Iron dose should be adjusted according to weight and milk type to avoid insufficient or excessive intake.

Aim to provide 2-3mg/kg/day if born < 34 weeks and < 1.8kg and 1-2ml/kg/day if born 34-37 weeks' gestation until 1 year of age.

Though giving iron supplements on an empty stomach improves absorption, to maximise tolerance, mix 0.5-1ml Sytron (27.5mg per 5ml) with 6-12ml milk when giving 0.5-1ml.

**Table 1: Monitoring iron levels**

	Deficiency	Iron overload
Ferritin level	< 35-40µg/L	>300-350µg/L
Dose adjustment	Increase iron dose to 3-4 mg/kg/day (< 6 mg/kg/day) (Embleton et al, 2022)	Stop iron supplementation > 300µg/L
Considerations	Ferritin should be used as a marker of iron status (Embleton et al, 2022). Repeated measurements should be taken and interpreted. Infants receiving erythropoietin treatment may require higher doses of iron, up to 6 mg/kg/day.	An intake of >3 mg/kg/day for more than a few weeks should be avoided due to risk of adverse effects. Raised ferritin level not accurate with inflammation, infection or liver disease

**Table 2: Vitamin and mineral prescribing**

Born	Appropriate milks	Vitamins A&D	Iron
<b>Commence</b>	PN contains vitamins, not iron	when enteral feeds reach 120ml/kg/day	At 2 weeks of age
<b>&lt; 34 / 40 OR &lt; 1.8kg</b>	EBM + BMF Nutriprem 1 / 2	0.6ml Abidec	Prescribe to actual weight: < 1.5kg = 0.5ml Sytron per day > 1.5kg = 1ml Sytron per day Stop if on Nutriprem 1 & 2
<b>34+1 - 37 / 40 AND &lt; 2.5kg</b>	Breast milk Term formula	0.6ml Abidec  Stop > 500ml formula	1ml Sytron  Stop if on formula
<b>&gt; 37 / 40 OR &gt; 2.5kg</b>	Breast milk Term formula	0.3ml Abidec* Stop > 500ml formula	No

\*Parents of babies born >37 weeks to purchase over the counter or from healthy start if appropriate.

Dietetic referral should be made for preterm babies who are not on the appropriate milk for gestation to advise on vitamin supplementation.

For babies born < 37 weeks gestation, continue Abidec and Sytron until 1 year actual age (ESPGHAN, 2023)

## 2.6 On discharge

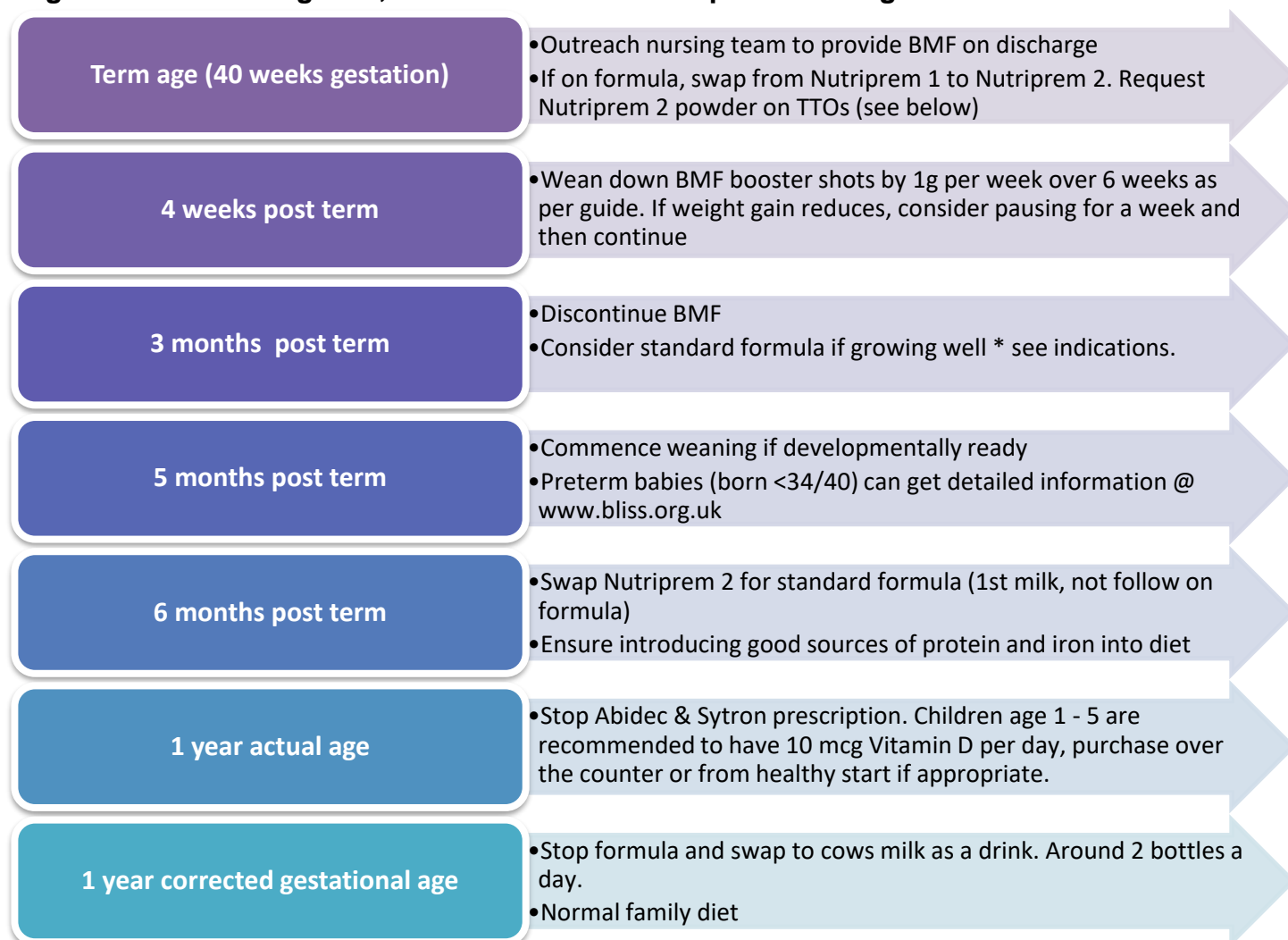
The UHL Neonatal service discharges babies < 35/40 gestation when stable but requiring support for either establishing oral feeds with the use of home nasogastric tube feeding or home oxygen, and babies born > 35/40 who remain < 1.8kg.

We should promote transition to breast feeding pre and post discharge. It is important for babies to continue to grow well, breast feeding cessation is more common in those with poor weight gain due to parental anxiety and a loss of confidence in breastfeeding (Tully et al, 2017).

Combination feeding is possible; however, bottle feeding is a different skill, and babies must learn to feed effectively. Allow a minimum of 2 weeks whenever possible to establish breast feeding before introducing bottle feeding. Refer to the infant feeding team for support if required. When bottle feeding, try to encourage a parent to feed the baby for consistency.

See breast feeding support UHL obstetric guideline, expressed breast milk guideline, donor expressed breast milk guideline, skin to skin guideline, kangaroo care guideline.

## Diagram 2: Prescribing milk, vitamins A&D and Iron post discharge



BMF on discharge;

- Give 6 sachets BMF per day.
- Mix 1g sachet of BMF into 6 bottles / NGT top ups per day OR if breastfeeding, combine into 3 BMF boosters if preferred (Mix 2 x 1g BMF sachet into 5-10ml EBM).
- BMF should be prescribed until 1 month post term and weaned down slowly, stopping by 3 months post term (Table 3).
- If weight gain reduces, consider pausing weaning down for a week and then continue.
- Refer to dietitian if weight gain is reducing in centiles.

**Table 3: How to wean down BMF**

Week	Sachets of BMF per day
On discharge to 4 weeks CGA	6
1	5
2	4
3	3
4	2
5	1



### Post discharge formula (e.g. Nutriprem 2);

Babies growing well on a nutrient enriched, low birth weight formula should normally be prescribed a post-discharge formula (e.g. Nutriprem 2) until 3 months post term  
Consider continuing up to 6 months CGA where;

- Growth is suboptimal.
- Weight before 2.5kg / <9<sup>th</sup> centile.
- Not tracking along a centile line within 2 centiles of their birth centile.
- Reducing in the centile for weight.
- Increased nutritional requirements e.g. chronic lung disease or congenital heart disease.

### On discharge, prescribe;

- 28 ready-to-feed 90ml bottles of Nutriprem 2
- 1 x 800g tin of Nutriprem 2 powder.
- TTO for repeat prescription from the GP, prescribe;
- 5 x 800g packs of post discharge formula (e.g. Nutriprem 2) per 28 days.

Ready to feed formulas should not be prescribed unless exceptional circumstances exist due to price being fourfold with no clinical benefit.

Nutricia Cow & Gate recommend introducing 1 bottle of powdered formula a day, with the remaining feeds to be given as ready-to-feed liquid formula (See table 4).

**Table 4: Transition from ready-made to powdered Nutriprem based on 8 feeds a day:**

Day at home	Number of feeds	
	Ready-to-feed liquid formula	Powdered formula
1	7	1
2	6	2
3	5	3
4	4	4
5	3	5
6	2	6
7	1	7
8	0	8

## 2.7 Growth

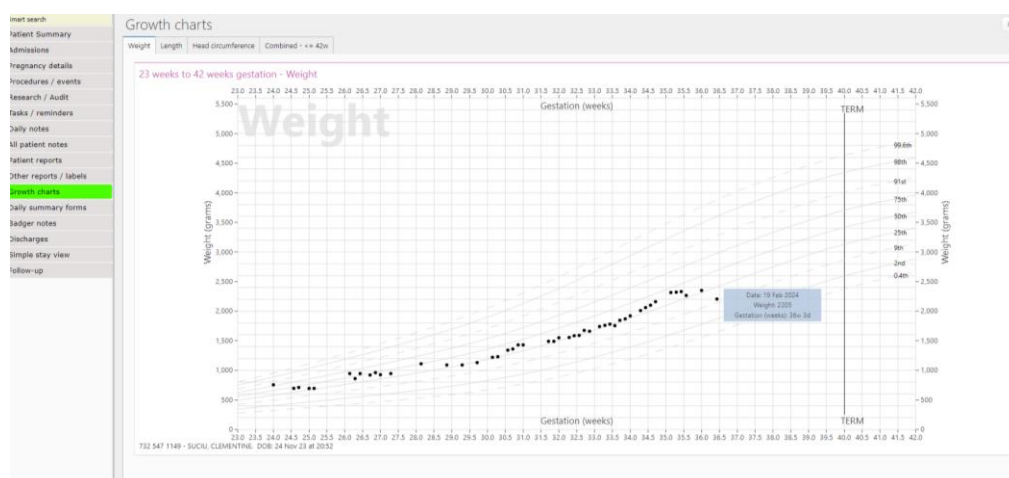
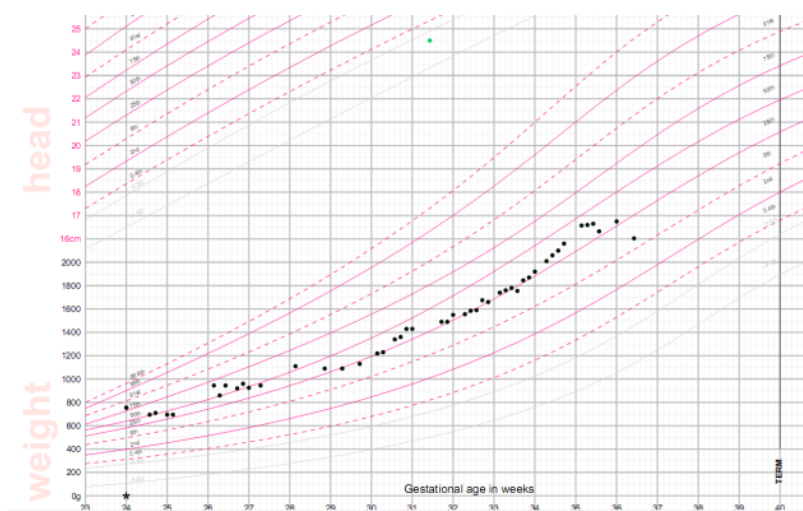
It is important to monitor growth in babies, as they should grow proportionally (weight, length and head circumference) and / or along a centile line.

The target weight centile for preterm babies may differ from birth centile and may reduce 1-2 centiles due to the initial diuresis post birth; weight loss in the first few days of life of 7-10% is often considered acceptable (Landau-Crangle et al, 2018, NICE 2017). However, more recent studies suggest that growth has improved over the last decade and can match intra-uterine growth when nutritional requirements are met (Andrews et al, 2019).



- Monitor growth on badgernet using an RCPCH neonatal and infant close monitoring growth chart (NICM) using the 'centile tab'.
- The growth chart tab on badgernet can show the corrected gestational age if you hover over the most recent plotted data.
- Weight, length and OFC should be plotted on badgernet on the date they were measured
- Weight should be recorded as 'current weight'. Working weight does not annotate the growth chart.
- Working weight should be routinely updated twice weekly on weigh days using the new weight unless the consultant specifies working weight for clinical reasons such as oedema. This should include ITU babies who may have a daily weight measured to ensure twice weekly adjustment of fluids and PN allowances.
- Weight should be checked with different weighing scales if there is an increase of more than 60g per day as this may indicate fluid overload if correct.
- Head circumference (OFC) should be measured on admission and weekly.
- Length should aim to be monitored weekly on stable babies especially those in SCBU and as a minimum, on transfer to and discharge from the nursery.

**Diagram 3: Example growth charts from badgernet**



### 3. Education and Training

None

### 4. Monitoring Compliance

What will be measured to monitor compliance	How will compliance be monitored	Monitoring Lead	Frequency	Reporting arrangements
BMF and Formula prescribed appropriately to preterm infants according to weight and gestation criteria above (100%)	audit			

### 5. Supporting References

1. Aggett PJ, Agostoni C, Axelsson I, De Curtis M, Goulet O, Hernell O, Koletzko B, Lafeber HN, Michaelsen KF, Puntis JW, Rigo J, Shamir R, Szajewska H, Turck D, Weaver LT. (2006) ESPGHAN Committee on Nutrition; Feeding preterm infants after hospital discharge: a commentary by the ESPGHAN Committee on Nutrition. *J Pediatr Gastroenterol Nutr.* May;42(5):596-603. doi: 10.1097/01.mpg.0000221915.73264.c7. PMID: 16707992.
2. Agostoni C, Buonocore G, Carnielli VP, De Curtis M, Darmaun D, Decsi T, Domellöf M, Embleton ND, Fusch C, Genzel-Boroviczeny O, Goulet O, Kalhan S, Kolacek S, Koletzko B, Lapillonne A, Mihatsch W, Moreno L, Neu, Poindexter J, Puntis B, Putet J, Rigo G, Riskin J, Salle A, Sauer B, Shamir P, Szajewska R, Thureen H, Turck P, Van Goudoever D, Ziegler JB. (2019) ESPGHAN Committee on Nutrition. Enteral Nutrient Supply for Preterm Infants: Commentary From the European Society of Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. *Journal of Pediatric Gastroenterology and Nutrition* 50(1):p 85-91, January 2010. | DOI: 10.1097/MPG.0b013e3181adaee0
3. Andrews ET, Beattie RM, Johnson MJ. Measuring body composition in the preterm infant: Evidence base and practicalities. *Clin Nutr.* Dec;38(6):2521-2530. doi: 10.1016/j.clnu.2018.12.033. Epub 2019 Jan 12. PMID: 30737045.
4. Arslanoglu S, et al. (2019) Fortification of Human Milk for Preterm Infants: Update and Recommendations of the European Milk Bank Association (EMBA) Working Group on Human Milk Fortification. *Front. Pediatr.* 7:76. doi: 10.3389/fped.2019.00076
5. Aimone A (2009) Post-Discharge Feeding Study Group. Growth and body composition of human milk-fed premature infants provided with extra energy and nutrients early after hospital discharge: 1-year follow-up. *J Pediatr Gastroenterol Nutr*;49(4):456-66. <https://doi.org/10.1097/MPG.0b013e31819bc94b>
6. Alyahya W, Simpson J, Garcia A, L, Mactier H, Edwards C, A: Early versus Delayed Fortification of Human Milk in Preterm Infants: A Systematic Review. *Neonatology* 2020;117:24-32. doi: 10.1159/000501279
7. Baird J, Fisher D, Lucas P, Kleijnen J, Roberts H, Law C. Being big or growing fast: systematic review of size and growth in infancy and later obesity. *BMJ.* 2005 Oct 22;331(7522):929. doi: 10.1136/bmj.38586.411273.E0. Epub 2005 Oct 14. PMID: 16227306; PMCID: PMC1261184.
8. Beauport L, Schneider J, Faouzi M, Hagmann P, Hüppi PS, Tolsa JF, Truttmann AC, Fischer Fumeaux CJ. Impact of Early Nutritional Intake on Preterm Brain: A Magnetic Resonance Imaging Study. *J Pediatr.* 2017 Feb;181:29-36.e1. doi: 10.1016/j.jpeds.2016.09.073. Epub 2016 Nov 10. PMID: 27837953.

9. Belfort., M.B., Rifas-Shiman., S.L., Sullivan., T., Collins., C.T., McPhee., A.J. and Ryan. P. (2011) 'Infant growth before and after term: effects on neurodevelopment in preterm infants', *Pediatrics*, 128(4), pp. 899-906. Available at: <https://doi.org/10.1542/peds.2011-0282>
10. Beunders VAA, Roelants JA, Hulst JM, Rizopoulos D, Hokken-Koelega ACS, Neelis EG, de Fluiter KS, Jaddoe VWV, Reiss IKM, Joosten KFM, Vermeulen MJ. Early weight gain trajectories and body composition in infancy in infants born very preterm. *Pediatr Obes*. 2021 Jun;16(6):e12752. doi: 10.1111/ijpo.12752. Epub 2020 Nov 17. PMID: 33205622; PMCID: PMC8244114.
11. Biasini, A., Neri, C., China, M. C., Monti, F., Di Nicola, P. and Bertino, E. (2012) 'Higher protein intake strategies in human milk fortification for preterm infants feeding. Auxological and neurodevelopmental outcome', *J Biol Regul Homeost Agents*, 26(3 Suppl), pp. 43-7
12. BrownJV, LinL, EmbletonND, HardingJE, McGuireW. Multi-nutrient fortification of human milk for preterm infants. *Cochrane Database of Systematic Reviews* 2020, Issue 6. Art. No.: CD000343. DOI: 10.1002/14651858.CD000343.pub4.
13. Cooke R.W. (2006) Are there critical periods for brain growth in children born preterm? *Archives of Disease in Childhood: Foetal Neonatal Ed*. 91(1), 17-20.
14. Cooke R, Goulet O, Huysentruyt K, Joosten K, Khadilkar AV, Mao M, Meyer R, Prentice AM, Singhal A. Catch-Up Growth in Infants and Young Children With Faltering Growth: Expert Opinion to Guide General Clinicians. *J Pediatr Gastroenterol Nutr*. 2023 Jul 1;77(1):7-15. doi: 10.1097/MPG.0000000000003784. Epub 2023 Mar 28. PMID: 36976274; PMCID: PMC10259217.
15. Cole TJ, Statnikov Y, Santhakumaran S, Pan H, Modi N; Neonatal Data Analysis Unit and the Preterm Growth Investigator Group. Birth weight and longitudinal growth in infants born below 32 weeks' gestation: a UK population study. *Arch Dis Child Fetal Neonatal Ed*. 2014 Jan;99(1):F34-40. doi: 10.1136/archdischild-2012-303536. Epub 2013 Aug 9. PMID: 23934365; PMCID: PMC3888637.
16. Cordova EG, Cherkerzian S, Bell K, Joung KE, Collins CT, Makrides M, Gould J, Anderson PJ, Belfort MB. Association of Poor Postnatal Growth with Neurodevelopmental Impairment in Infancy and Childhood: Comparing the Fetus and the Healthy Preterm Infant References. *J Pediatr*. 2020 Oct;225:37-43.e5. doi: 10.1016/j.jpeds.2020.05.063. Epub 2020 Jun 7. PMID: 32525038.
17. Cormack BE, Harding JE, Miller SP, Bloomfield FH. The Influence of Early Nutrition on Brain Growth and Neurodevelopment in Extremely Preterm Babies: A Narrative Review. *Nutrients*. 2019 Aug 30;11(9):2029. doi: 10.3390/nu11092029. PMID: 31480225; PMCID: PMC6770288.
18. Dabydeen L. et al. (2008) High-energy and -protein diet increases brain and corticospinal tract growth in term and preterm infants after perinatal brain injury. *Paediatrics*. 121(1), 148-56.
19. Embleton, N., Sissel, J.M., Lapillonne, Van den Akker, C., Virgilio, C., Fusch, C., Gerasimidis, K., van Goudoever, J., Haiden, N., Iacobelli, S., Johnson, M., Meyer, S., Mihatsch, W., del Pipaon, M., Rigo, J., Zachariassen, G., Bronsky, J., Indrio, F., Köglmeier, J., de Koning, B., Norsa, L. and Verduci, D.M. (2022) 'Enteral Nutrition in Preterm Infants: A Position Paper From the ESPGHAN Committee on Nutrition and Invited Experts', *Journal of Pediatric Gastroenterology and Nutrition*, 76(2), pp. 248-268. Available at: <http://doi.org/10.1097/MPG.0000000000003642>
20. Ehrenkranz, R.A., Dusick, A.M., Vohr, B.R., Wright, L.L., Wrage, L.A. and Poole, W.K. (2006) 'Growth in the neonatal intensive care unit influences neurodevelopmental and growth outcomes of extremely low birth weight infants', *Pediatrics*, 117(4), pp. 1253-61. Available at: <https://doi.org/10.1542/peds.2005-1368>.
21. Ehrenkranz, R.A. (2013) Nutrition, growth and clinical outcomes. In: Koletzko, B., Poindexter, B. and Uauy, R. Nutritional care of preterm infants, *World Review of Nutrition and Dietetics*. Basel: Karger.

22. Franz AR, Mihatsch WA, Sander S, Kron M, Pohlandt F. Prospective randomized trial of early versus late enteral iron supplementation in infants with a birth weight of less than 1301 grams. *Pediatrics*. 2000 Oct;106(4):700-6. doi: 10.1542/peds.106.4.700. PMID: 11015511.
23. Enteral Nutrition in Preterm Infants (2022): A Position Paper from the ESPGHAN Committee on Nutrition and Invited Experts *J Pediatr Gastroenterol Nutr* 2023 Feb 1; 76(2):248-268. doi: 10.1097/MPG.0000000000003642.
24. Fenton TR, Nasser R, Eliasziw M, Kim JH, Bilan D, Sauve R: Validating the weight gain of preterm infants between the reference growth curve of the fetus and the term infant, The Preterm Infant Multicentre Growth Study. Submitted BMC Ped 2012).
25. Ingolfsson EC, Rubin N, Rao RB; Iron Status and Retinopathy of Prematurity Outcomes among Infants in the Preterm Erythropoietin Neuroprotection Trial (PENUT Trial). *Invest. Ophthalmol. Vis. Sci.* 2022;63(7):4175 – F0235.
26. Isaacs E.B. et al (2008) The effect of early human diet on caudate volumes and IQ. *Paediatric Research*. 63(3), 308-14.
27. Jin HX, Wang RS, Chen SJ, et al. Early and late iron supplementation for low birth weight infants: a meta-analysis. *Ital J Pediatr* 2015;41:16.
28. Koletzko B et al (2021) Nutritional Care of Preterm Infants: Scientific Basis and Practical Guidelines. *World Rev Nutrition and Dietetics*, Karger, Vol 122
29. Lapillonne A, Bronsky J, Campoy C, Embleton N, Fewtrell M, Fidler Mis N, Gerasimidis K, Hojsak I, Hulst J, Indrio F, Molgaard C, Moltu SJ, Verduci E, Domellöf M; ESPGHAN Committee on Nutrition. Feeding the Late and Moderately Preterm Infant: A Position Paper of the European Society for Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. *J Pediatr Gastroenterol Nutr*. 2019 Aug;69(2):259-270. doi: 10.1097/MPG.0000000000002397. PMID: 31095091.
30. Landau-Crangle E, Rochow N, Fenton TR, et al. Individualized Postnatal Growth Trajectories for Preterm Infants. *JPEN J Parenter Enteral Nutr*. 2018;42(6):1084-1092.
31. Li Y, Chi C, Li C, Song J, Song Z, Wang W, Sun J. Efficacy of Donated Milk in Early Nutrition of Preterm Infants: A Meta-Analysis. *Nutrients*. 2022 Apr 21;14(9):1724. doi: 10.3390/nu14091724. PMID: 35565692; PMCID: PMC9105142.
32. Marino LV, et al. (2019) Home use of breast milk fortifier to promote Post discharge growth and breast feeding in preterm infants: a quality improvement project *Arch Dis Child*;104:1007–1012. doi:10.1136/archdischild-2018-315951
33. Matinolli, H.M., Hovi, P., Männistö, S., Sipola-Leppänen, M., Eriksson, J.G., Mäkitie, O., Järvenpää, A.L., Andersson, S. and Kajantie, E. (2015) 'Early Protein Intake Is Associated with Body Composition and Resting Energy Expenditure in Young Adults Born with Very Low Birth Weight'. *J Nutr*, 145(9):2084-91. Available at: <https://doi.org/10.3945/jn.115.212415>.
34. Malikiwi, A.I., Lee, Y.M., Davies-Tuck., M. and Wong, F.Y. (2019) 'Postnatal nutritional deficit is an independent predictor of bronchopulmonary dysplasia among extremely premature infants born at or less than 28 weeks gestation'. *Early Hum. Dev*, 131, pp29–35. Available at: <https://doi.org/10.1016/j.earlhumdev.2019.02.005>.
35. McCormick K, King C, Clarke S, Jarvis C, Johnson M, Parretti HM, Greene N, Males J. The role of breast milk fortifier in the post-discharge nutrition of preterm infants. *Br J Hosp Med (Lond)*. 2021 Mar 2;82(3):42-48. doi: 10.12968/hmed.2021.0101. Epub 2021 Mar 9. PMID: 33792394.



36. Mihatsch WA, Högel J, Pohlandt F. Hydrolysed protein accelerates the gastrointestinal transport of formula in preterm infants. *Acta Paediatr.* 2001 Feb;90(2):196-8. doi: 10.1080/080352501300049442. PMID: 11236051.
37. Meyer S, Bay J, Franz AR, Erhardt H, Klein L, Petzinger J, Binder C, Kirschenhofer S, Stein A, Hüning B, Heep A, Cloppenburg E, Muyimbwa J, Ott T, Sandkötter J, Teig N, Wiegand S, Schroth M, Kick A, Wurm D, Gebauer C, Linnemann K, Kittel J, Wieg C, Kiechl-Kohlendorfer U, Schmidt S, Böttger R, Thomas W, Brevis Nunez F, Stockmann A, Kriebel T, Müller A, Klotz D, Morhart P, Nohr D, Biesalski HK, Giannopoulou EZ, Hilt S, Poryo M, Wagenpfeil S, Haiden N, Ruckes C, Ehrlich A, Gortner L; NeoVitaA trial investigators. Early postnatal high-dose fat-soluble enteral vitamin A supplementation for moderate or severe bronchopulmonary dysplasia or death in extremely low birthweight infants (NeoVitaA): a multicentre, randomised, parallel-group, double-blind, placebo-controlled, investigator-initiated phase 3 trial. *Lancet Respir Med.* 2024 Apr 18:S2213-2600(24)00073-0. doi: 10.1016/S2213-2600(24)00073-0. Epub ahead of print. PMID: 38643780.
38. Ming S, Zhang D, Chen L, Shi Y (2021) Effects of anemia and red blood cell transfusion in preterm infants on the development of bronchopulmonary dysplasia: a propensity score analysis, *All Life*, 14:1, 830-839, DOI: 10.1080/26895293.2021.1972350
39. Moody GJ, Schanler RJ, Lau C, Shulman RJ. Feeding tolerance in premature infants fed fortified human milk. *J Pediatr Gastroenterol Nutr.* 2000 Apr;30(4):408-12. doi: 10.1097/00005176-200004000-00011. PMID: 10776952.
40. Neonatal Dietitians Interest Group. The routine supplementation of vitamins and iron and the management of zinc deficiency in preterm and small for gestational age infants A Guideline for Clinical Practice January 2024).
41. Ng, DV., Brennan-Donnan, J., Unger, S., Bando, N., Gibbins, S., Nash, A., Kiss, A. and O'Connor, D. L. (2017) 'How Close Are We to Achieving Energy and Nutrient Goals for Very Low Birth Weight Infants in the First Week?', *JPEN J Parenter Enteral Nutr*, 41(3), pp. 500-506.
42. Ng DHC, Embleton ND, McGuire W. Hydrolyzed Formula Compared With Standard Formula for Preterm Infants. *JAMA.* 2018 Apr 24;319(16):1717-1718. doi: 10.1001/jama.2018.3623. PMID: 29710147.
43. Ng, D., Klassen, J., Embleton, N., & McGuire, W. (2019). Protein hydrolysate versus standard formula for preterm infants (review). *Cochrane Database of Systematic Reviews*, (7)
44. O'Connor DL, Kiss A, Tomlinson C, Bando N, Bayliss A, Campbell DM, et al. Nutrient enrichment of human milk with human and bovine milk-based fortifiers for infants born weighing <1250 g: a randomized clinical trial. *Am J Clin Nutr.* (2018) 108(1):108–16. doi: 10.1093/ajcn/nqy067
45. Ong KK, Kennedy K, Castañeda-Gutiérrez E, Forsyth S, Godfrey KM, Koletzko B, Latulippe ME, Ozanne SE, Rueda R, Schoemaker MH, van der Beek EM, van Buuren S, Fewtrell M. Postnatal growth in preterm infants and later health outcomes: a systematic review. *Acta Paediatr.* 2015 Oct;104(10):974-86. doi: 10.1111/apa.13128. PMID: 26179961; PMCID: PMC5054880.
46. Osmond C, Barker DJ. Fetal, infant, and childhood growth are predictors of coronary heart disease, diabetes, and hypertension in adult men and women. *Environ Health Perspect.* 2000 Jun;108 Suppl 3(Suppl 3):545-53. doi: 10.1289/ehp.00108s3545. PMID: 10852853; PMCID: PMC1637808.
47. Patel RM, Knezevic A, Shenvi N, Hinkes M, Keene S, Roback JD, Easley KA, Josephson CD. Association of Red Blood Cell Transfusion, Anemia, and Necrotizing Enterocolitis in Very Low-Birth-Weight Infants. *JAMA.* 2016 Mar 1;315(9):889-97. doi: 10.1001/jama.2016.1204. PMID: 26934258; PMCID: PMC4805423.
48. Rochow. N., Fusch. G., Mühlinghaus. A., Niesytto. C., Straube. S., Utzig. N. and Fusch. C. (2011) 'A nutritional program to improve outcome of very low birth weight infants', *Clin Nutr.* 31(1), pp. 124-31. Available at: <https://doi:10.1016/j.clnu.2011.07.004>

49. Rochow N, Raja P, Liu K, et al. Physiological adjustment to postnatal growth trajectories in healthy preterm infants. *Pediatric research*. 2016;79(6):870-879.
50. Roggero P, Gianni ML, Amato O, Liotto N et al (2012) Growth and fat-free mass gain in preterm infants after discharge: a randomized controlled trial. *Pediatrics*.;130(5):1215-21.
51. Sami AS, Frazer LC, Miller CM, Singh DK, Clodfelter LG, Orgel KA, Good M. The role of human milk nutrients in preventing necrotizing enterocolitis. *Front Pediatr*. 2023 Jun 2;11:1188050. doi: 10.3389/fped.2023.1188050. PMID: 37334221; PMCID: PMC10272619.
52. Senterre T, Rigo J. Hydrolyzed Proteins in Preterm Infants. *Nestle Nutr Inst Workshop Ser*. 2016;86:39-49. doi: 10.1159/000444199. Epub 2016 Jun 23. PMID: 27336633.
53. Singhal A, Fewtrell M, Cole TJ, Lucas A. Low nutrient intake and early growth for later insulin resistance in adolescents born preterm. *Lancet*. 2003 Mar 29;361(9363):1089-97. doi: 10.1016/S0140-6736(03)12895-4. PMID: 12672313.
54. Singhal A. Long-Term Adverse Effects of Early Growth Acceleration or Catch-Up Growth. *Ann Nutr Metab*. 2017;70(3):236-240. doi: 10.1159/000464302. Epub 2017 Mar 17. PMID: 28301849.
55. Quigley M, Embleton ND, McGuire W. (2019). Formula versus donor breast milk for feeding preterm or low birth weight infants. *Cochrane Database of Systematic Reviews*, (7)
56. Premkumar MH, Pammi M, Suresh G. Human milk-derived fortifier versus bovine milk-derived fortifier for prevention of mortality and morbidity in preterm neonates. *Cochrane Database Syst Rev*. (2019) 2019(11):CD013145. doi: 10.1002/14651858.CD013145.pub2
57. Stacy, E. et al (2014). Metabolic bone disease of prematurity. *Journal of Clinical and translational endocrinology*. [Online] 1, 85-91. [Viewed 23/07/19]. Available from doi: <https://dx.doi.org/10.1016%2Fj.jcte.2014.06.004>
58. Teller, I., Embleton, N., Griffin, I., & Elburg, R. (2016). Post discharge formula feeds in preterm infants: Systematic review mapping evidence about role of macronutrient enrichment. *Clinical Nutrition*, 35(4), 791-801.
59. Thanigainathan S, Abiramalatha T. Early fortification of human milk versus late fortification to promote growth in preterm infants. *Cochrane Database Syst Rev*. 2020 Jul 29;7(7):CD013392. doi: 10.1002/14651858.CD013392.pub2. PMID: 32726863; PMCID: PMC7390609.
60. Tully KP. et al. (2017) The relationship between infant feeding outcomes and maternal emotional well-being among mothers of late preterm and term infants: a secondary, exploratory analysis. *Adv Neonatal Care* 17:65–75.
61. Vaag A. Low birth weight and early weight gain in the metabolic syndrome: consequences for infant nutrition. *Int J Gynaecol Obstet*. 2009 Mar;104 Suppl 1:S32-4. doi: 10.1016/j.ijgo.2008.11.026. Epub 2009 Jan 19. PMID: 19155006.
62. Walsh, V., Brown, J., Askie, L., Embleton, N., & McGuire, W. (2019). Nutrient- enriched formula versus standard formula for preterm infants (review). *Cochrane Database of Systematic Reviews*, (7)
63. Young L, Embleton ND, McGuire W. Nutrient-enriched formula versus standard formula for preterm infants following hospital discharge. *Cochrane Database Syst Rev*. 2016 Dec 13;12(12):CD004696. doi: 10.1002/14651858.CD004696.pub5. PMID: 27958643; PMCID: PMC6463855.

64. Young A, Beattie RM, Johnson MJ. Optimising growth in very preterm infants: reviewing the evidence. Arch Dis Child Fetal Neonatal Ed. 2023 Jan;108(1):2-9. doi: 10.1136/archdischild-2021-322892. Epub 2022 Feb 28. PMID: 35228320.
65. Zachariassen G. et al.(2011) Nutrient enrichment of mother's milk and growth of very preterm infants after hospital discharge.Pediatrics.127(4):e995-e1003. <https://doi.org/10.1542/peds.2010-0723>

## 6. Key Words

Breast milk, Breast milk fortifier (BMF), Donor expressed milk, Expressed milk, Formula, Growth chart, Iron, Preterm

**The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs.**  
**As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.**

Contact and review details			
Guideline Lead (Name and Title) Authors: Rachel Fox Deepa Panjwani - Consultant			Executive Lead Chief Medical Officer
Details of Changes made during review:			
Date	Issue Number	Reviewed By	Description Of Changes (If Any)
Dec 2013	1		New document
7/1/2014 - 20/5/2014	2	Neonatal Guidelines Meeting Neonatal Governance Meeting	minor amendments ratified
June 2018	3	Neonatal Governance	agreement to ratify for a further year (no amendments made)
Sept 2019	4	Neonatal Guidelines	agreement to ratify for a further year ( no amendments made)
Jan 2021 – Feb 2021	5	Neonatal Guidelines Meeting Neonatal Governance Meeting	
April 2024 - May 2024	6	Neonatal Guidelines Meeting Neonatal Governance Meeting	Key points updated; Gestation and weight increased to less than 34 weeks (previously <32/40) and less than 1800g (previously <1500g) Breast milk is the choice for all infants (previously stated term formula is the feed of choice for infants 34-37 weeks) Entire guideline updated in line with the change in key points. Table 5 (appendix 1) updated Addition of appendices 2-7



**Appendix 1: Table 5. Table displaying nutrition provided by preterm and term formula if fed at 150-175ml/kg/day**

	Nutritional requirements		Nutriprem 1	Nutriprem 2	Term formula
	Term (per kg/day)	ESPGHAN 2022 (1.0-1.8kg)	Feeds volumes of 150- 180ml/kg/d provide		
<b>Energy (Kcal/kg/day)</b>	96-120	115 – 140 (140-160*)	120 - 144	108 - 130	99 - 119
<b>Protein (g/kg/day)</b>	2.6	3.5 - 4.0 (< 4.5g/kg/day*)	4.0 - 4.8	3.0 - 3.6	1.9 - 2.2
<b>Sodium (mmol/kg/day)</b>	1.5	3 – 5 (< 8)	4.5 - 5.4	1.8 - 2.2	1.4 - 1.6
<b>Potassium (mmol/kg/day)</b>	2.3 – 4.6	3.44			
<b>Calcium (mmol/kg/day)</b>	2.1	3 – 5	3.7 - 4.5	3.1 - 3.7	2.2 - 2.6
<b>Phosphate (mmol/kg/day)</b>	3.8	2.2 – 3.7	3.0 - 3.6	2.2 - 2.6	-
<b>Vitamin D (µg/d)</b>		10 - 25	4.6 - 5.5	2.7 - 3.3	2.5 - 2.8
<b>Vitamin A</b>		400 - 1100 µg RE/kg/d	549 - 659	150 - 180	87 - 101
<b>Iron (mg/kg/d)</b>	RNI 1.3mg/day EAR 1.7mg/day	(from 2 weeks old) < 34 / 40: 2 – 3 (< 6) 34 – 36 + 6 / 40: 1-2	2.4 - 2.9	1.8 - 2.2	1 – 1.2

\* Where growth is slow

**Table 6: Vitamin content of vitamin supplement available on prescription**

	Vitamin A (mcg / IU)	Vitamin D (mcg/ IU)
Dalivit 0.6ml	5000	10 / 400
Abidec 0.6ml	1333	10 / 400

## Appendix 2: Raised nutritional requirements

Preterm babies born <34 weeks' gestation or <1.8kg have increased energy requirements as per the latest ESPGHAN position paper (Embleton et al, 2022). Small for gestational age (SGA) babies (Weight <2.5kg or <9th centile\*) also have raised nutritional requirements due to a need for rapid growth (Bauer et al, 2011). \*Note that 1.8kg is on the 9th centile at 35/40 and – 4SD at term and 2.6kg is on the 9th centile at term gestation.

Energy and protein requirements reduce around term CGA for most preterm babies. However, will remain high in those with comorbidities including chronic lung disease (CLD), cardiac abnormalities (ASD, VSD) and other conditions which increase energy needs or reduce absorption.

Early adequate nutrition improves clinical outcomes by reducing infection, retinopathy of prematurity (ROP) (Smith and Hard., 2013; Koletzko et al., 2021), chronic lung disease (CLD) (Malikiwi et al., 2019), and improves neurodevelopment (Cormack et al., 2019; Beauport et al., 2017; Ehrenkrantz et al., 2006). Furthermore, better nutritional support improves growth and neurodevelopmental outcomes (Ehrenkrantz et al., 2013; Koletzko et al., 2021).

Suboptimal intake of protein, calcium, sodium and phosphate is associated with poor growth (both brain and lean body mass) and suboptimal bone mineralisation (Stacy et al, 2014; Cooke R, 2006; Isaacs et al, 2008; Luca et al, 2008; Dabydeen et al, 2008). To support growth in preterm babies, both breast and formula milks need to be fortified with additional energy, protein minerals and vitamins (ESPGHAN, 2022).

### Appendix 3: Growth monitoring

Growth charts use foetal weight estimates or birthweights to predict growth trajectories and debate exists whether this describes physiological or desirable growth. Preterm studies mostly include well babies, with those with lower apgar scores, or other clinical problems being excluded or demonstrating lower growth (Young et al, 2023).

It is commonly accepted that weight loss in the first 2 weeks of life is inevitable, so many aim for preterm babies to follow a centile up to 2 centiles below to birth centile (Agostoni 2010; Cole et al, 2014; Rochow et al, 2016).

Diagram 4: Post-natal weight loss after preterm birth

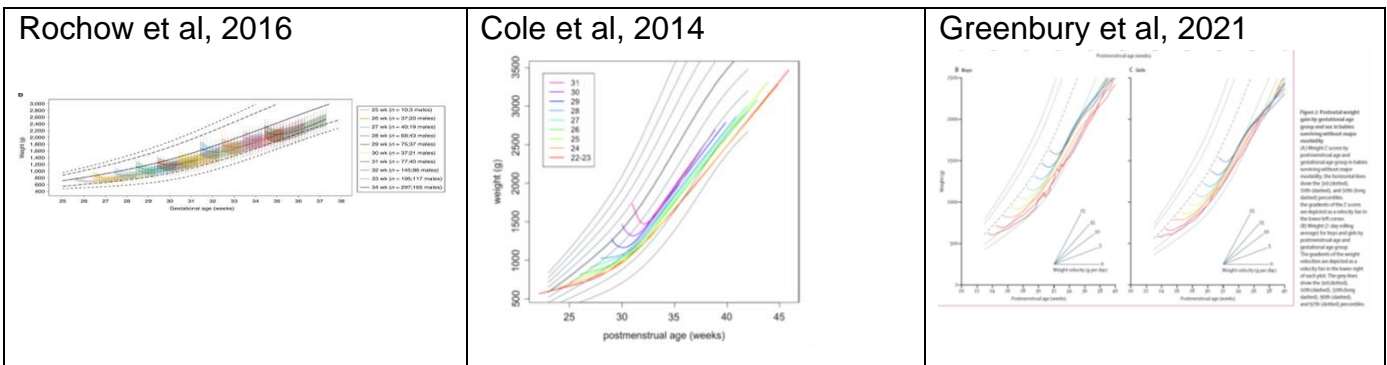
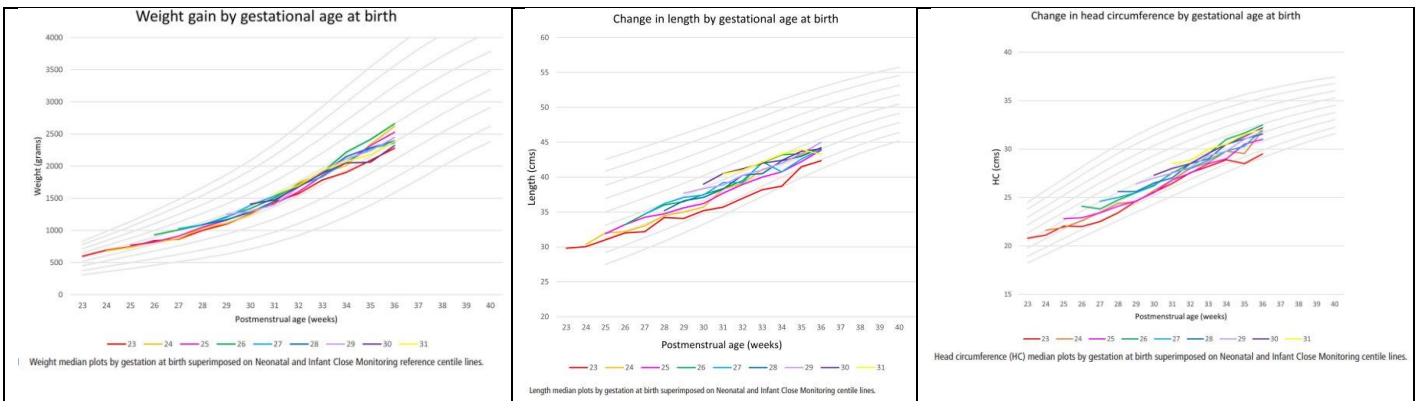


Diagram 5: Maintenance of weight, length and OFC (Andrews et al, 2019)



However, most preterm babies are born at a lower weight to term babies of the same gestational age who remain in utero and thus have some kind of IUGR.

Catch up weight gain in preterm and SGA babies is appropriate and should not be considered excessive when increasing in centiles where weight is below birth centile. Earlier recovery of birth centile prevents nutritional deficits which make it difficult to establish later catch-up weight gain (Rochow et al, 2012). Catch up should begin prior to 36 weeks CGA (Fenton et al, 2013). In

practice excessive weight gain is unusual, and babies rarely gain weight above their birth centile even with the routine use on PN and enriched infant milks. In their retrospective study of 120 infants born <30/40 gestation, despite use of PN followed by BMF at 100ml/kg/day and preterm formula in the absence of EBM, babies did not meet their birth z-scores by discharge, and fat mass during infancy was linked with weight gain on discharge and not during admission (Beunders et al, 2021).

Systematic review of observational studies consistently reports positive associations between postnatal weight or head growth and neurodevelopment (Ehrenkrantz et al., 2006; Cordova et al, 2020; Belfort et al, 2011; Singhal, 2017).

It is important to note the difference between accelerated growth i.e. above target centiles and catch-up weight gain. Catch up growth in term babies after a period of growth faltering and growth acceleration where weight increases through the centiles are different and require further research (Cooke et al, 2023). Concern about long-term metabolic and cardiovascular effects of catch-up weight gain is not supported by good quality studies (Cole et al, 2014; Ong et al, 2015).

There is a concern that an association exists between low birth weight and later heart disease (Osmond and Barker, 2000) with rapid weight gain being associated with an increased risk of cardiometabolic outcomes (Vaag et al, 2009, Belfort et al, 2013), obesity and diabetes (Baird et al, 2005) in term babies. However, a linear regression analysis of 335 babies showed that use of fortifier and enriched preterm formula increasing protein intake was associated with healthier body composition, accompanied by a higher metabolic rate, in young adults born with VLBW 20 years earlier (Matinolli et al, 2015). Other studies suggest that foetal undernutrition can programme insulin resistance (Osmond and Barker, 2000), and conversely, use of enriched formulas in preterm babies may increase later insulin resistance, however this was only to match that of term babies (Singhal et al, 2003).

## Appendix 4: Enriched preterm formula and post discharge formula for preterm babies

### Breast Milk Fortifier

BMF is associated with improved weight gain, length and head growth (Ng et al, 2017; Brown et al, 2020), as well as improved neurological outcomes (Biasini et al, 2012). Use of fortified DEBM may achieve comparable growth to preterm formula (Li et al, 2022). BMF is tolerated well with no delay to establishing full feeds (Moody et al, 2000), with no evidence of harm (Brown et al, 2020).

ESPGHAN recommend commencing BMF when enteral intake reaches 40-100ml/kg/day (Embleton et al, 2022). Some studies suggest that BMF should be started early rather than late (Alyayah et al, 2020, Huston et al, 2020). However, Cochrane reviews identified 2 small RCTs showing no evidence of harm or benefit when started  $< / > 100\text{ml/kg/day}$  (Thanigainathan and Abiramalatha, 2020).

Use of BMF appears to have a positive impact on breastfeeding rates (Arsanoglu et al, 2019, Zachariassen et al, 2011). Some small studies (n=29-39) have demonstrated improved weight gain and growth when BMF is continued post discharge up to 1 year of age (Aimone et al, 2009; Marino et al, 2019). There is a consensus of opinion that continuing BMF post discharge improves weight gain and preserves breast feeding post – discharge (McCormick et al, 2020).

Another Cochrane review identified one RCT (n= 127 babies), which showed no benefit to using human derived BMF with no improvement in feeding tolerance, growth and morbidity including NEC (O'Connor et al, 2018; Premkumar et al, 2019). There are concerns about the expense, efficacy, ethics and safety of human derived milk fortifiers and they are not currently available in the UK.

### Preterm Formula

A Cochrane review (Walsh et al, 2019) investigating the growth and development of infants given nutrient enriched Vs standard formula identified 7 trials (n= 590) and found modest effects on growth rates during their initial hospital admission with no increase in NEC.

Few participants were extremely preterm, extremely low birth weight, or growth restricted. All studies were small, prior to 1992 with data in the 70s-80s, and were formula industry funded. Most of the studies aimed to assess effects of the intervention on growth rates during hospitalisation not post discharge (time to regain birth weight and rate of gain in weight, length, or head circumference while in hospital or until reaching a specified weight). Forest plots show benefit to weight, ofc and length, IQ / bayley psychomotor development, However, there is no sub group analysis  $<28/40$  or SGA.

We do not recommend the use of hydrolysed preterm formula, which has been associated with

accelerated gastrointestinal transit time (Mihatsch, 2001), reduced mineral absorption (Senterre et al, 2016) and a slower weight gain (Ng *et al*, 2018, Ng et al, 2020) compared to intact protein formulas with no improvement to feed intolerance or necrotising enterocolitis. Systematic reviews comparing formula (term or preterm) versus DEBM (unfortified or fortified) for feeding preterm (<37/40) or low birth weight infants (<2.5kg) found that feeding with any formula was associated with improved weight gain, linear growth and head growth but had an increased risk of developing necrotising enterocolitis (Li et al, 2022; Quigley et al, 2018).

### **Post discharge Formula**

A Cochrane review identified 16 trials of variable quality including 1251 babies, which compared feeding infants with 'post discharge formula' (energy density about 74 kcal/100 mL) versus standard term formula (about 67 kcal/100 mL) but did not find any consistent effects on growth parameters up to 12 to 18 months post term in infants routinely given post discharge formula. However, there was little data on neurological outcomes and no data for later childhood. Importantly, feeding nutrient enriched formula (80kcal/100ml) demonstrated improved growth at 12-18 months (Young et al, 2016). Previously ESPGHAN had recommended that post discharge formulas are continued to term or around 12 weeks CGA (Aggett et al, 2006, Lucas et al, 2001).

Similarly in a review that analysed 31 methodologically heterogeneous studies, energy (>80kcal/100ml) and protein (ratio 2.5-3 (10-12%) until 6 months CGA) enriched diets post discharge improved weight, length and OFC as well as lean body mass with no negative effects (Teller et al, 2016).

All studies in both reviews are over 10 years old, CGA was not defined in the Cochrane review, and as such, we should consider post discharge as term CGA as discharge from hospital would likely have been nearer term when these studies were conducted.

## Appendix 5: Term formula

**Table 7: Milk selection for term babies with feeding concerns**

Problem	Rationale	Formula to prescribe	How to prescribe
Poor weight gain / restricted volumes	High energy 100kcal/100ml	Infatrini	*See above
Chylothorax	80% MCT	Monogen	100% of feeds for 4 weeks if formula fed.
Established renal failure	Reduced protein, phosphate and potassium	Renastart	Renal consultant or renal specialist dietitian to advise
Malabsorption	Hydrolysed protein, low lactose, 50% MCT	Aptamil Peptijunior	High output stoma + poor weight gain
Cows Milk Protein Allergy (CMPA)	Extensively hydrolysed Whey protein. Halal, vegan.	SMA Althera	See guideline for specialist infant formula for proven and suspected cows milk allergy
Alternative for CMPA	Extensively hydrolysed, Casein based, lactose free, probiotics	Nutramigen LGG 1	Mum to go milk free if EBM fed, and to use milk post dietary exclusion only. Prescribe for 100% of feeds if formula fed.
CMPA + symptomatic on hydrolysed formula	Amino Acid based	Alfamino / Neocate LCP	If symptoms persist on extensively hydrolysed formula, consider an amino acid base formula.

Term formula can be considered post term CGA when babies are growing well (centiles for weight, length and OFC are in proportion), tracking above or less than 2 centiles below birth centile for weight. NB. Preterm babies often reduce up to 1 centile due to the initial diuresis post birth.

\*For term babies receiving breast milk (EBM or breast fed) with poor weight gain, introduce 1-2 top up feeds of 50% feed volume of Infatrini per day initially, e.g. 3 kg baby requires 150ml/kg/day = 3kg x 150ml = 450ml/8 = 56ml per feed/2 = 28ml. So, give 1-2 x 28ml top ups of Infatrini per day.



## Appendix 6: Vitamin and mineral supplementation

The third trimester of pregnancy is a period of rapid nutrient accretion and the time when fat-soluble vitamin stores are laid down. Premature birth interrupts this process, consequently preterm infants born < 34 weeks gestation have lower stores of fat-soluble vitamins (A & D) and higher micronutrient requirements than those born at term.

All breastfed babies born >34 / 40 weeks' gestation should be recommended to give 8.5 to 10 micrograms vitamin D supplement daily from birth to 1 year of age. Those having >500ml formula do not need a vitamin supplement. If alternative products are used, refer to the NDIG routine supplementation guideline (NDIG, 2024).

Abidec is the vitamin of choice as the dose of Vitamin A is appropriate to meet and not exceed nutritional requirements for preterm babies. DaliVit® is not recommended as a first line preparation as it has a much higher vitamin A content than other preparations. Therefore, it is not a directly interchangeable product with others on the market. Consider additional vitamin D and folic acid if breast milk is not fortified with BMF. See appendix 4.

Dalivit can be given as an alternative where the family express concerns regarding cross reaction to **peanut** in the home. See Appendices for prescribing advice. **CAUTION:** Follow advice in Appendix 4 if this product is being used alongside fortified breast milk or formula.

**ALLERGIES:** Abidec is the vitamin of choice across much of the UK. Dalivit contains high levels of Vitamin A which may be hepatotoxic. Abidec contains **arachis oil** which is derived from peanut.

Abidec recommend that this product is not used in children with peanut or soya allergies though there are no reported cases of anaphylaxis to **peanut**.

A literature review (Divall, P. Evidence Search: ABIDEC and allergy/anaphylaxis. Leicester: University Hospitals of Leicester NHS Trust Libraries and information services, 13/3/24) of this topic demonstrated that awareness of Abidec containing peanut oil is low (Subramanian, 2012), however there are no studies that report presence or absence of peanut anaphylaxis or allergy due to use of Abidec.

There was a recent prospective, multicentre, randomised, parallel-group, double-blind, placebo-controlled, investigator-initiated phase 3 trial published in the Lancet which showed no improvement in BPD when using a 5000IU/day using Abidec Vs 1000IU and peanut oil, all infants were supplemented with 1000IU/day Vitamin A. There was no difference in adverse events (BPD / NEC / ROP / death) or in serum retinol levels and no mention of allergy or anaphylaxis (Meyer et al, 2024).

### Iron

- Preterm and low birth weight infants are at risk of deficiency due to low stores at birth, higher requirements due to rapid growth, losses caused by frequent blood sampling and the requirement for parenteral nutrition support for the smallest and sickest infants, which does not routinely contain iron (Koletzko et al, 2021). Furthermore, iron deficiency is common in babies born <2.5kg (Lapillone et al, 2019).
- Early and adequate iron supplementation, is essential to prevent anaemia of prematurity, improving serum ferritin and haemoglobin levels and reducing iron deficiency (Jin et al, 2015; Ingolfssland et al, 2022). Supplementing from 2–3 weeks versus 4–8 weeks of age is associated with a lower need for blood transfusions in VLBW infants (Franz et al, 2000; Jin et al, 2015; Embleton et al, 2022).
- Blood transfusion is used to correct iron deficiency, larger volume and higher number of RBC transfusions have been linked with BPD and its severity (Ming et al, 2021).
- RCTs in late preterm infants have shown improved developmental outcomes in iron supplemented infants (Embleton et al, 2022).
- Iron deficiency anaemia should be avoided as it may adversely affect clinical outcomes including BPD, NEC and neurodevelopment (Patel et al, 2016).
- Excessive intakes of iron can also be detrimental to preterm infants and should be avoided, as there is no mechanism for excretion. Excess iron may increase oxidative stress and associated complications of prematurity (Koletzko et al, 2021).
- Where there is a family history of peanut anaphylaxis, the following regimen may be used (NDIG, 2024):

The Neonatal Dietitians Interest Group have recently published recommendations for vitamin and mineral supplementation (*Neonatal Dietitians Interest Group. The routine supplementation of vitamins and iron and the management of zinc deficiency in preterm and small for gestational age infants A Guideline for Clinical Practice* January 2024).

## Appendix 7: Breast feeding assessment tools:

These should be used with mothers to assess if baby is breast feeding well and to consider how much of a top up to give based on feeding.

**Breastfeeding assessment tool: Neonatal**

How you and your nurse/midwife can recognise that your baby is feeding well								*please see reverse of form for guidance on top-ups post-breastfeed
What to look for/ask about	✓	✓	✓	✓	✓	✓	✓	
<b>Your baby:</b>								
Is not interested, when offered breast, sleepy (*A)								
Is showing feeding cues but not attaching (*B)								
Attaches at the breast but quickly falls asleep (*C)								
Attaches for short bursts with long pauses (*D)								
Attaches well with long rhythmical sucking and swallowing for a short feed (requiring stimulation) (*E)								
Attaches well for a sustained period with long rhythmical sucking and swallowing (*F)								
Normal skin colour and tone								
Gaining weight appropriately								
<b>Your baby's nappies:</b>								
At least 5-6 heavy, wet nappies in 24 hours								
At least 2 dirty nappies in 24hrs, at least £2 coin size, yellow and runny								
<b>Your breasts:</b>								
Breasts and nipples are comfortable								
Nipples are the same shape at the end of the feed as at the start								
Referred for additional breastfeeding support								
<b>Date</b>								
<b>Midwife/nurse initials</b>								
Midwife/nurse: If any responses not ticked: watch a full breastfeed, develop a care plan including revisiting positioning and attachment and/or refer for additional support. Consider specialist support if needed.								<p><b>Wet nappies:</b> Day 1-2 = 1-2 or more in 24 hours Day 3-4 = 3-4 or more in 24 hours, heavier Day 6 plus = 6 or more in 24 hours, heavy</p> <p><b>Stools/dirty nappies:</b> Day 1-2 = 1 or more in 24 hours, meconium Day 3-4 = 2 (preferably more) in 24 hours changing stools By day 10-14 babies should pass frequent soft, runny stools everyday; 2 dirty nappies in 24 hours being the minimum you would expect.</p> <p>Exclusively breastfed babies should not have a day when they do not pass stool within the first 4-6 weeks. If they do then a full breastfeed should be observed to check for effective feeding. However, it is recognised that very preterm babies who transition to breastfeeding later may have developed their individual stooling pattern before beginning to breastfeed, and therefore this may be used as a guide to what is normal for each baby.</p> <p><b>Feed frequency:</b> Babies who are born preterm/sick may not be able to feed responsively in the way a term baby does. It is important that they have 8-10 feeds in 24 hours and they may need to be wakened if they don't show feeding cues after 3 hours. During this time it is important that you protect your milk supply by continuing to express.</p> <p>Being responsive to your baby's need to breastfeed for food, drink, comfort and security will ensure you have a good milk supply and a secure, happy baby.</p>

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### Breastfeeding assessment score to determine tube top ups

adapted from Imperial College Hospitals NHS Trust



To be used in conjunction with the assessment of maternal lactation, attachment and signs of effective milk transfer

Score	Definition	Action
<b>A</b>	Offered the breast, not showing feeding cues, sleepy	Full top up
<b>B</b>	Some interest in feeding (licking and mouth opening/head turning) but does not attach	Full top up
<b>C</b>	Attaches onto the breast but comes on and off or falls asleep	Full top up
<b>D</b>	Attaches only for a short burst of sucking, uncoordinated with breathing and swallowing and/or frequent long pauses	Half top up if the mother is available for next feed. The baby may wake early
<b>E</b>	Attaches well, long, slow, rhythmical sucking and swallowing – sustained for a short time with breasts not softened throughout	Half top up if mother is not available for next feed. If mother is available for next feed do not top up, and assess effectiveness of next feed.
<b>F</b>	Attaches well, long, slow, rhythmical sucking and swallowing – sustained for a longer time with breasts feeling soft following feed	No top up

## Tool for mothers to assess breastfeeding

Mothers should be taught to use the breast-feeding score to decide if to top up their baby when establishing breast feeding.

### How can I tell that breastfeeding is going well?

 <b>Breastfeeding is going well when:</b>	 <b>Talk to your midwife / health visitor if:</b>
Your baby has 8 feeds or more in 24 hours	Your baby is sleepy and has had less than 6 feeds in 24 hours
Your baby is feeding for between 5 and 40 minutes at each feed	Your baby consistently feeds for 5 minutes or less at each feed Your baby consistently feeds for longer than 40 minutes at each feed
	Your baby always falls asleep on the breast and/or never finishes the feed himself
Your baby has normal skin colour	Your baby appears jaundiced (yellow discolouration of the skin)  <small>Most jaundice in babies is not harmful, however, it is important to check your baby for any signs of yellow colouring particularly during the first week of life. The yellow colour will usually appear around the face and forehead first and then spread to the body, arms and legs. A good time to check is when you are changing a nappy or clothes. From time to time press your baby's skin gently to see if you can see a yellow tinge developing. Also check the whites of your baby's eyes when they are open and the inside of his/her mouth when open to see if the sides, gums or roof of the mouth look yellow</small>
Your baby is generally calm and relaxed whilst feeding and is content after most feeds	Your baby comes on and off the breast frequently during the feed or refuses to breastfeed
Your baby has wet and dirty nappies (see chart over page)	Your baby is not having the wet and dirty nappies explained overleaf
Breastfeeding is comfortable	You are having pain in your breasts or nipples, which doesn't disappear after the baby's first few sucks. Your nipple comes out of the baby's mouth looking pinched or flattened on one side
When your baby is 3-4 days old and beyond you should be able to hear your baby swallowing frequently during the feed	You cannot tell if your baby is swallowing any milk when your baby is 3-4 days old and beyond
	You think your baby needs a dummy
	You feel you need to give your baby formula milk

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## Nappies

**The contents of your baby's nappies will change during the first week. These changes will help you know if feeding is going well. Speak to your midwife if you have any concerns**

<b>Baby's age</b>	<b>Wet nappies</b>	<b>Dirty nappies</b>
<b>1-2 days old</b>	1-2 or more per day urates may be present*	1 or more dark green/black 'tar like' called meconium
<b>3-4 days old</b>	3 or more per day nappies feel heavier	At least 2, changing in colour and consistency – brown/green/yellow, becoming looser ('changing stool')
<b>5-6 days old</b>	5 or more Heavy wet**	At least 2, yellow; may be quite watery
<b>7 days to 28 days old</b>	6 or more heavy wet	At least 2, at least the size of a £2 coin yellow and watery, 'seedy' appearance

\*Urates are a dark pink/red substance that many babies pass in the first couple of days. At this age they are not a problem, however if they go beyond the first couple of days you should tell your midwife as that may be a sign that your baby is not getting enough milk.

\*\* With new disposable nappies it is often hard to tell if they are wet, so to get an idea if there is enough urine, take a nappy and add 2-4 tablespoons of water. This will give you an idea of what to look/feel for.