East of England Neonatal ODN
(Hosted by Cambridge University Hospitals)

Clinical Guideline: Post-discharge use of Human Milk Fortifier (HMF) in preterm infants

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For use in: EoE Neonatal Units
Guidance specific to the care of neonatal patients.

Used by: Neonatal nurses and medics, Neonatal dietitians, Community outreach teams.

Key Words:

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Approved by:

Neonatal Clinical Oversight Group	
Clinical Lead Matthew James	**Matthew James**

Audit Standards:

Audit points:

100% of infants who meet the criteria for HMF at home are in receipt of treatment, in accordance with this guideline, at the point of discharge.
100% parents receive face to face and written instructions in the delivery and management of HMF at home.
100% infants in receipt of HMF at home, have fortification discontinued in line with the guidelines in this document.

Introduction & rationale:

The implementation of standardised nutrition guidelines in neonatal units has led to improvements in the nutritional intake of preterm infants and a reduction in growth failure, both during the infant's hospital stay and at point of discharge. (1,2). However ongoing concerns remain in regard to the incidence of growth failure in infants once at home, with some reports citing an incidence of up to 45% (3).

Growth failure has been associated with longer term consequences, including poorer neurocognitive outcomes (4) therefore optimising growth around the time of discharge is important in order to improve longer term outcomes, especially for those infants receiving exclusive maternal milk, or exclusively breastfeeding.

Preterm infants are born at a time when in utero growth rates would have been 2-3 times greater than a baby born at term. As a result, current nutritional guidelines recommend intakes of key nutrients that are higher than those for a term baby.(5) (table 1) These increased nutritional requirements cannot be met by a straight increase in volume of breast milk (table 2), therefore available guidelines state that all preterm infants receiving milk feeds and who have a birth weight <1800g should receive additional nutritional supplements.(5,6) It is this requirement that has led to the development of specialist formulas and human milk fortifiers (HMF) for use in the preterm population.

Table 1: ESPGHAN (2022) versus term recommended macro and micronutrient provision.

Nutrient	ESPGHAN recommended amount (per kg/day)	Term (per kg/day)
Energy, kcals/kg/day	110 – 140Kcal/kg/day (140-160 where growth is slow)	96 – 120
Protein, g/kg/day	3.5 - 4.0g/kg/day (increasing to 4.5g/kg/day where growth is slow)	2.6
Carbohydrate, g/kg/day	11 - 15	
Sodium, mmol/kg/day	3 – 8	1.5
Potassium, mmol/kg/day	2.3 – 4.6	3.4
Calcium, mmol/kg/day	3 - 5	2.1
Phosphate, mmol/kg/day	2.2 – 3.7	3.8
Iron mg/kg/day	2 - 3	1.7 mg/day

Table 2 nutrient provision of expressed breast milk.

nutrient	Recommended amount (per Kg/day)	150ml/kg EBM	165ml/kg EBM	180ml/kg EBM
Energy kcal/kg	110-140	102	110	121
Protein g/kg	3.5 – 4.0	2.4 (preterm) 2.0 (mature)	2.6 (preterm) 2.1 (mature)	2.9 (preterm) 2.3 (mature)
Calcium mmol/kg	3-5	1.1	1.2	1.35
Phosphate mmol/kg	2.2-3.7	0.7	0.8	0.9
Iron mmol/kg	2-3	0.1	0.13	0.14

A preterm infant would require >250ml/kg of early preterm or >300ml/kg mature breast milk in order to meet their protein requirements. Suboptimal intake of protein, calcium, sodium and phosphate is associated with poor growth (both brain and lean body mass) and suboptimal bone mineralisation. (7-11)

Current practice for formula fed preterm infants who have failed to demonstrate 'catch up' growth during their neonatal stay, or who have a proven need for increased nutritional requirements (eg BPD or cardiac infants) is to transition, prior to discharge home, onto a specially formulated nutrient dense post-discharge formula (NDPDF) in order to maintain their higher nutrient intake. There is however, no such recommendation for those infants receiving fortified breast milk or transitioning from tube feeds to breastfeeding. Current practise is generally to stop fortification during the transition period, such that infants are discharged home with no nutrient supplementation and with a subsequent reduced nutritional provision. Discharge also often coincides with the time when an infant's sleep/wake pattern and possibly oral motor maturity is not fully developed. This means that they have a reduced ability to upregulate their breastmilk volume, thereby putting them at risk of poor growth.

Maintenance of appropriate growth is important for the long-term success of breastfeeding as poor growth can increase parental anxiety and a loss of confidence in breastfeeding, leading to early breastfeeding cessation (12) or to prompt healthcare professionals to advise supplementing with formula feeds.

Although the continuation of human milk fortification after discharge is not currently standard practice in the East of England, there is some evidence to suggest that adopting this practice can produce sustained improvements in various growth parameters (13-16). Therefore providing HMF to selected infants around the time of discharge and beyond may offer a way of ensuring they receive adequate nutrition in the first few weeks at home, thereby optimising their growth and helping to prevent growth failure beyond discharge.

Concerns around the use of HMF

Mothers may be less willing to continue breastfeeding if they feel the continuation of HMF infers that their own milk is not adequately meeting her baby's needs. Reassurance, however can be given, as there is some evidence that use of fortifier beyond discharge not only has no impact on the duration of breastfeeding (13,15,17) but it actually has the potential to further protect breast feeding in the preterm population (16)

Although data is limited, there is no evidence linking the use of HMF to necrotising enterocolitis (NEC) in either systematic reviews and randomised control trials (18)

The addition of HMF to expressed breast milk inevitably causes an increase in osmolality due to the enzymatic (lactase) hydrolysis of maltodextrin. Historically raised osmolality of feeds has been linked with NEC, however recent systematic reviews have not found any consistent evidence that feeds with an osmolality in the range 300-500mOsm/kg/H2O are associated with adverse gastrointestinal symptoms in neonates (19,20) Fortified breast milk has an osmolality of 390-450 mOsm/Kg/H20, well within the recommended range, however, re-warming fortified expressed breast milk (EBM) and/or preparing significantly in advance of use has the potential to increase osmolality, with a further 10% increase after storage at 4 degrees C for up to 24 hours (5). In order to minimise any potential for increased osmolality, supplements should ideally, be made immediately prior to a breast feed using freshly expressed milk, and not prepared in advance and stored in the refrigerator.

Who should receive HMF post discharge?

Despite the widespread use of HMF for preterm babies on neonatal units, the literature shows few reports of its use post discharge, as a result there is no consensus across the country as to which infants should receive HMF at home. With the development and extension of outreach services across the UK, it is becoming increasingly common practice for preterm infants to be discharged home at earlier gestations and with lower discharge weights. Subsequently the maintenance of human milk fortification is becoming an increasingly practical option for infants establishing breast feeding and transitioning from tube feeding at home. (16,17,21)

A pragmatic, best practice approach might therefore be to mirror the principle behind the use of post discharge formulas for formula fed babies, i.e. to bridge the gap between a nutrient dense milk to one of lower density for those infants where a need for nutritional supplementation has been clearly recommended (ie. those born <1800g).(5) Studies that looked specifically at post discharge use of HMF showed no negative impact on breastfeeding rates and indeed suggested some advantages.(22)

Consequently recommendations have been made that HMF is continued in preterm breast fed babies either to term or around 52 weeks post conceptional age, according to their growth trajectory (23,24)

Criteria for use of BMF post discharge:

- <34 weeks or any gestation infant with birth weight < 1800g and have dropped **up to one centile** in weight from that achieved **after the initial diuresis** on a UK Neonatal and Infant close monitoring (NCIM) growth chart:

  Aim to give 4 x HMF 'supplements' per day, spread evenly between breastfeeds, up to 44 weeks of age (ie 4 weeks post term)

- <34 weeks or any gestation infant with birth weight <1800g and have dropped by **more than one centile** in weight from that achieved **after the initial diuresis** on a UK Neonatal and Infant close Monitoring Chart (NCIM) growth chart:

  Aim to give 6 HMF 'supplements' per day, spread evenly between breastfeeds, up to 48 weeks of age (ie 8 weeks post term)

When to stop HMF post discharge:

Decisions as to when to discontinue fortification should reflect the specific features of each individual case, however the following guidance should be followed in conjunction with careful monitoring of the infant's growth using a UK NICM growth chart.

Where an infant is able to maintain its weight along the same centile, it may be possible to reduce the dose of fortifier sooner. Earlier discontinuation of fortification should also be considered if the infant's weight crosses to a higher marked centile line which is out of proportion with length.

- <34 weeks or any gestation infant with birth weight < 1800g and have dropped **up to one centile** in weight from that achieved **after the initial diuresis** on a UK Neonatal and Infant close monitoring (NCIM) growth chart:

  Reduce to 2x HMF 'supplements' per day at 44 weeks

  Reduce to 1x HMF 'supplements' per day at 45 weeks

  Stop HMF at 46 weeks.

- <34 weeks or any gestation infant with birth weight <1800g and have dropped by **more than one centile** in weight from that achieved **after the initial diuresis** on a UK Neonatal and Infant close Monitoring Chart (NCIM) growth chart:

Reduce to 5x HMF 'supplements' per day at 48 weeks
Reduce to 4x HMF 'supplements' per day at 49 weeks
Reduce to 2x HMF 'supplements' per day at 50 weeks
Reduce to 1x HMF 'supplements' per day at 51 weeks
Stop HMF at 52 weeks

Monitoring

Regular monitoring of infants discharged on HMF is essential, as rapid and excessive catch up growth can be unbeneficial. There is some evidence of an increased risk of insulin resistance and cardiovascular disease in later life for those infants that experience excessive weight gain and who cross weight percentiles in the first few months of life. (25,26,27). Careful consideration needs to be given to balancing the well-documented neurocognitive risks of nutrient deficiencies and slow growth in early life, against these theoretical risks from rapid catch-up growth of adverse metabolic programming in later life (5)

It is important to monitor weight gain closely to ensure growth velocity is appropriate. However weight gain alone should not be used as a marker for adequate nutrition, as it does not reflect the actual composition of the mass that the infant is accruing– ie lean body mass (muscle and tissue) or non-lean body mass (fat). Length and head circumference are equally important. They should be measured and plotted on the UK NIMC growth chart, and alongside weight, be assessed regularly, as both the quantity and quality of growth need to be considered when monitoring the impact of HMF post discharge.

Monitoring and follow up should ideally be managed by the unit neonatal outreach team alongside their neonatal dietitian. Where outreach teams have yet to be established, or where teams discharge infants to community care at 44 weeks, monitoring should continue, via the neonatal or paediatric dietitian, until the point at which fortification is stopped, with input from community nursing staff or health visitors. The dietitian will liaise with community staff to agree and facilitate opportunities for infants to be regularly weighed and lengthed (ideally weekly for weight) so that progress can be mapped by the dietitian in conjunction with the baby's parents. (28)

If growth appears to be faltering during the initial period of treatment with HMF, then it is recommended that the infant be reviewed by the neonatal or paediatric dietitian, and referred to a lactation specialist/infant feeding specialist for further assessment. (28) Parents should be given the contact details of the outreach team, dietetic team, or equivalent service, for advice on non-urgent issues related to the infant's growth and the use and supply of HMF. HMF will need to be supplied by the neonatal unit until the point at which fortification is stopped (this may well be beyond the point at which the

baby is discharged to community care). It is important to advise parents of the potential implications of over-nutrition.

What HMF to use:

Currently two breast milk fortifier products are available and used for home fortification in the UK: Nutriprem Human Milk Fortifier (Nutriprem HMF) and SMA Gold Prem Breast Milk Fortifier (SMA BMF). Choice of fortifier for home use will be dictated by the product used within the local neonatal unit.

Nutriprem HMF has recently been reformulated and is now available in a 1g sachet. It is a nutritionally incomplete, multi-component human milk fortifier containing extensively hydrolysed protein, long chain polyunsaturated fatty acids (LCPUFAs) including docosahexaenoic acid (DHA) and arachidonic acid (ARA), and micronutrients.

SMA Gold Prem Breast Milk fortifier is available in 1g sachets. It is a nutritionally incomplete, multi-component human milk fortifier containing extensively hydrolysed protein, long chain polyunsaturated fatty acids (LCPUFAs) including docosahexaenoic acid (DHA), and micronutrients, including iron.

Nutriprem HMF is available on prescription from a GP on FP10. An initial supply should be given to parents at discharge alongside a suitably amended copy of the GP prescription letter, found in **appendix 2**, for further supplies. SMA HMF remains unavailable on FP10 and therefore needs to be prescribed by a hospital physician and provided, for the duration of treatment, by the acute neonatal unit team.

Additional nutrition obtained / day from HMF 'supplements':

Fortifier	Per 1g sachet SMA Gold Prem BMF	4 x supplements /day	6x supplements /day	Per 1g scoop/sachet Nutriprem HMF*	4x supplements /day	6x supplements /day
Energy(Kcal)	4.3	17	25.8	4	16	24
Protein (g)	0.36	1.44	2.16	0.33	1.32	1.98
Fat (g)	0.18	0.72	1.08	0.18	0.72	1.08
Carbohydrate (g)	0.32	1.28	1.92	0.37	1.48	2.22
Calcium (mg)	19 (0.47mmol)	76 (1.9mmol)	114 (2.82mmol)	17.3 (0.43mmol)	69.2 (1.72mmol)	103.8 (2.58mmol)
Phosphorus (mg)	11	44	66	9.49 (0.31mmol)	37.72 (1.24mmol)	56.94 (1.86mmol)
Iron (mg)	0.45**	1.8**	2.7**	0	0	0

*Nutriprem HMF (29).

** SMA BMF contains iron therefore additional oral iron supplementation is **not** required whilst an infant is receiving SMA BMF at home. Iron supplementation should be commenced in line with the East of England ODN iron guideline once SMA BMF has stopped and the infant is on exclusive unfortified breastfeeding. (30)

How to give HMF:

Continuing HMF at home can be a time consuming and challenging experience for parents, therefore the acute neonatal team must ensure that parents are fully informed as to the steps involved, and that they receive both written instructions, as well as face to face training in the handling, mixing and administration of the fortifier prior to discharge. (see appendix 1)

HMF is delivered as a 'supplement' which constitutes 1x 1g sachet of either SMA BMF or 1g sachet of Nutriprem HMF mixed with 5-10ml freshly expressed breast milk. This is then delivered via a spoon, syringe or cup (depending on local practice for the protection of breastfeeding) or via a bottle teat if the baby is already receiving some bottle feeds.

HMF will dissolve more readily if added to EBM at body temperature (ideally), or room temperature. Put EBM in a small feeding bottle and gently swirl until dissolved. The bottle must not be rapidly agitated, or a froth allowed to form, as this disrupts the fat globules within the milk.

A HMF 'supplement' should be prepared and given to the baby immediately before a full breastfeed so as to 'dilute' the nutrient concentrate.

HMF 'supplements' should be evenly distributed across daytime feeds and not given all at once.

HMF 'supplements' should **never** be added to formula feeds.

Parents should be advised that 'more is not necessarily better' and that their infant's appetite and feeding behaviour will change as they reach full term age. Babies are likely to feed more frequently as feeding skills and stamina mature, so parents need to be advised not to add extra fortifier beyond that recommended by the hospital team.

Parents should be advised to seek help from their outreach team or neonatal dietitian if the wish to reduce or stop breast feeding any point during this treatment.

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29	Nutriprem HMF Data card November 2022
30	SMA Gold Prem BMF data card February 2022

Acknowledgements – thanks to Norfolk and Norwich University Hospital on whose parent leaflet this sample is based.

Appendix 1 – sample parent leaflet

Use of human milk fortifier (HMF) at home

Whilst in hospital, your baby has been receiving human milk fortifier (HMF) in your expressed breast milk. This has been added in order to meet the very high nutritional requirements of a preterm baby, and to support good growth. You may also have seen this referred to as Breast Milk Fortifier or 'BMF'

Some babies, particularly those that were born very small or very early, may continue to have high nutritional requirements after they go home. They may continue to need this extra nutrition when at home, even after their nasogastric tube is removed.

For these babies we can give the human milk fortifier (HMF) in small amounts of expressed milk. We call these fortifier 'supplements'

You will be supported in learning how to make up and give these fortifier 'supplements', prior to taking your baby home.

Breastfeeding at home with human milk fortifier (HMF) supplements

It's important that your baby continues to effectively breast feed 2-3 hourly having at least 8 feeds within 24 hours.

Signs of effective feeding include good weight gain, wet and dirty nappies and visible signs that your baby is sucking and swallowing breast milk.

If you have any concerns about your baby's feeding then please speak with the neonatal outreach team, your midwife or health visitor.

How much HMF will my baby need?

Your neonatal outreach team, or dietitian will help you to decide how much HMF your baby will receive. This will be dependent upon the age of your baby at birth, and their growth on the unit:

- If your baby was born less than 34 weeks gestation, or had a birth weight less than 1800g AND have dropped down by **up to one growth line ('centile')** in weight on their growth chart :

  Aim to give 4 x HMF 'supplements' per day, spread evenly between breastfeeds, until your baby is 44 weeks of age (ie 4 weeks after their original 'due' date)

☐ If your baby was born less than 34 weeks gestation, or have a birth weight less than 1800g AND have dropped down **more than one growth line ('centile')** in weight on their growth chart:

Aim to give 6 HMF 'supplements' per day, spread evenly between breastfeeds, until your baby is 48 weeks of age (ie 8 weeks after their original 'due' date)

How and when do I stop HMF?

The decision to stop HMF will be made with your outreach team / dietitian or health visitor, and will generally follow the plan below.

If however your baby is able to maintain their weight along a growth line ('centile') on their growth chart, or if their weight line is greater and out of proportion with their length, reduction of HMF, or stopping early may be considered.

☐ If your baby was born less than 34 weeks gestation, or had a birth weight less than 1800g AND have dropped down by **up to one growth line ('centile')** in weight on their growth chart :

Reduce to 2x HMF "supplements" per day at 44 weeks

Reduce to 1x HMF "supplements" per day at 45 weeks

Stop HMF at 46 weeks.

☐ If your baby was born less than 34 weeks gestation, or have a birth weight less than 1800g AND have dropped down **more than one growth line ('centile')** in weight on their growth chart:

Reduce to 5x HMF "supplements" per day at 48 weeks
Reduce to 4x HMF "supplements" per day at 49 weeks
Reduce to 2x HMF "supplements" per day at 50 weeks
Reduce to 1x HMF "supplements" per day at 51 weeks
Stop HMF at 52 weeks

How to make the fortified breastmilk supplement

- Before you start make sure the work surface in the kitchen is clean and dry.
- Wash your hands with soap and water and dry them well.
- Express breast milk using your usual method.
- Measure 5mls of expressed breast milk into a sterile bottle.

- Add 1 sachet of breast milk fortifier to the 5mls breast milk.
- Gently shake the bottle until the powder has dissolved.

How to give fortified breast milk supplement at home alongside breastfeeds

- Give the 5mls of your fortified breast milk either using a syringe or teat before each full breastfeed 4 or 6 times per day.

How to give your baby fortified breast milk supplement by syringe

- Hold your baby in an upright position.
- Slowly syringe 0.2mls at a time into your baby's mouth.
- Slowly squeeze the milk to the side of their gums and cheek or onto the front part of their tongue.
- Let your baby swallow the fortified breast milk supplement before giving another 0.2mls.
- Continue to do this until the entire supplement has been given.

How to give your baby fortified breast milk by a teat

- Place your baby in the elevated left side position- you will be shown this prior to going home.
- Gently offer your baby the teat by running it along their bottom lip.
- When they open their mouth put the teat in ensuring their tongue is in the bottom of their mouth.
- Squirt the 5mls of fortified breast milk towards the tip of the teat and allow your baby to suck at the teat until the teat is empty.

How to give fortified breast milk supplements alongside bottle feeding

- If you have chosen to bottle feed your baby expressed breast milk, fortified breast milk supplements should be given separately as a small 5ml bottle feed.
- Offer a 5ml fortified breast milk supplement via a bottle 4 or 6 times per day before each feed.
- Follow this with the remainder of the expressed breast milk in a separate bottle.

Please contact the Neonatal Community Outreach Nurses, Neonatal Dietitian or NICU if:

- You are having problems with making or giving the fortified breastmilk supplements.
- You are concerned your baby is not tolerating the fortified breast milk supplement.
- You are having any problems giving the additional vitamins or iron.
- Your baby is having fewer than 6 feeds in 24 hours.
- Your baby has not gained any weight in a week (or has lost weight)

Other Information

- Sachets of fortifier are supplied by Neonatal unit only. They are not available from your GP or to buy.
- Sachets of breast milk fortifier should **NEVER** be added to infant formula.
- If you choose to give your baby formula whilst your baby still requires breastmilk fortifier supplements, please contact your Neonatal Community Outreach Team or Neonatal dietitian for further advice.

Neonatal Community Outreach Team: contact details

Neonatal Dietitian: contact details

Appendix 2 – GP prescription letter for Nutriprem HMF

[INSERT NAME & ADDRESS]

[INSERT DATE]

Dear [INSERT NAME]

RE: NUTRIPREM HUMAN MILK FORTIFIER PRESCRIPTION REQUEST

[INSERT PATIENT NAME HERE] has been receiving nutriprem human milk fortifier whilst in our care on the Neonatal Unit and we have recommended to continue its use for a short period after discharge.

Nutriprem human milk fortifier is ACBS approved and available on FP10 prescription and I would be grateful if you would prescribe it for the above infant.

Information to support prescribing on FP10:

Product	Prescribable unit	PIP Code	Cost
nutriprem human milk fortifier 1g sachet	1 x box (50 x 1g sachets)	419-4882	£10.63

Please prescribe [INSERT NUMBER] boxes of nutriprem human milk fortifier (50 x 1g sachets per box).

Parents should mix the sachets with warm expressed breastmilk (approx. 37°C), carefully following the dosage and preparation instructions provided by us as follows: [INSERT USAGE/PREPARATION INSTRUCTIONS GIVEN]. Human milk fortifier should never be added to infant formula.

Please see the link for our network guideline which provide further information https://www.eoeneonatalpccsicnetwork.nhs.uk/neonatal/downloads/bmfpostdischarge/

Continued growth monitoring is recommended to ensure optimal progress. This will be provided via the Outreach Team / Health Visitor / or [INSERT PROVISION AVAILABLE LOCALLY] (please delete as appropriate).

[PATIENT NAME HERE] will be reviewed again at [INSERT UNIT DETAILS] / (TIME & DATE). However, they can contact us at any time should further advice be required. Please contact us if infants are having issues taking any prescribed fortifier supplements, if they wish to change to mixed or formula feeding, or if you have any other concerns around growth or nutrition.

If you have any queries, please contact me on [INSERT CONTACT DETAILS].

Yours sincerely

[INSERT SIGNATURE/NAME]

IMPORTANT NOTICE: Breastfeeding is best. Nutriprem human milk fortifier is a food for special medical purposes for the dietary management of preterm and low birthweight infants. It should only be used under medical supervision, after full consideration of the feeding options available including breastfeeding. It is not suitable for use as the sole source of nutrition.

East of England Neonatal ODN
(Hosted by Cambridge University Hospitals)

Exceptional Circumstances Form

Form to be completed in the **exceptional** circumstances that the Trust is not able to follow ODN approved guidelines.

Details of person completing the form:	
Title:	Organisation:
First name:	Email contact address:
Surname:	Telephone contact number:
Title of document to be excepted from:	
Rationale why Trust is unable to adhere to the document:	
Signature of speciality Clinical Lead: Date:	Signature of Trust Nursing / Medical Director: Date:
Hard Copy Received by ODN (date and sign):	Date acknowledgement receipt sent out:

Please email form to: kelly.hart5@nhs.net requesting receipt.

Send hard signed copy to:

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EOE ODN Office Manager
Box 402
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Robinson Way
Cambridge University Hospital
Hills Road
Cambridge CB2 0SW