

FORMULA PREPARATIONS IN NEWBORN CARE CENTRE

This Local Operating Procedure is developed to guide safe clinical practice in Newborn Care Centre (NCC) at The Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this Local Operating Procedure.

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INTRODUCTION

- Expressed breastmilk (EBM) with multi-nutrient fortification is our first preference in extreme to very preterm infants.
- Occasionally, formula preparations are used as medically indicated.
- This guideline assists staff in calculating the amount of powdered formula to be added to set volumes of sterile water to achieve the desired calories.
- Composition of breastmilk varies among individuals and from feed to feed within the same individual. Estimated average calorie content of expressed breastmilk is 20 kcal/30 mL or 67 kcal/100 mL.
- The guide is calculated in a pragmatic way with the assumption that breastmilk or standard formula preparation on average provide 20 kcal/30 mL or 67 kcal/100 mL.
- Standard formulas differ in the calorie and nutrient content, but for practical purposes, average calorie content of the standard formula is considered equivalent to breastmilk.

SCOPE

- This guideline includes commonly used formulas in our Newborn Care Centre (NCC).
- Preparations not used in our NCC are beyond the scope of this guideline.

1. AIM

- To guide the amount of powdered formula to be added to the set volumes of sterile water to provide prescribed concentration of enteral nutrients for the neonate.

2. PATIENT

- Newborns

3. STAFF

- Medical and nursing staff

4. CLINICAL PRACTICE

- Medical staff to prescribe on the fluid chart: type of enteral feeds (e.g. expressed breastmilk, formula, fortifier), calorie content per 30 mL and the volumes to be fed.
 - Example: For a calculated weight of 1 Kg at 150 ml/kg/day 1 hourly feeds of Peptijunior 22 cal preparation
Prescribe: Peptijunior 22 kcal/30 mL 12 ml x 2 x 12 or 12 mL 2 hourly
- Formula preparation: Nursing staff to determine the brand and amount of formula powder to be added to the set volume of sterile water using the tables below.

Term Formula Preparations

Aptamil Gold+ Term Formula (Ready to Feed)

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	20	66	1.3 g	315
Protein – Casein/Whey Ratio			38%/62%	
Hydrolysed Protein			No	

FORMULA PREPARATIONS IN NEWBORN CARE CENTRE cont'd**Aptamil Gold+HA Term Formula (Ready to Feed)**

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	20	65	1.5	380
Protein – Casein/Whey Ratio			100% whey	
Hydrolysed Protein			Yes (Partial)	

Aptamil Gold Pronutra Stage 1 (Tin) – (Not Ready to Feed Preparation)

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
Standard: 1 scoop to 50 mL	19	64	1.4 g	326
1 scoop to 45 mL	21	71		N/A
1 scoop to 40 mL	24	80		N/A
1 scoop to 35 mL	27	91		N/A
1 scoop to 31 mL	30	100		N/A

*1 scoop = 7.4 g

S26-Gold Alula Newborn (Term) Ready to Feed (LBW RTF) formula

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	20	66	1.28 g	
Protein-Casein/Whey ratio			35%/65%	
Hydrolysed protein			No	

OPTIPRO GOLD 1 RTF formula (Ready to Feed)

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	20	67	1.3 g	311
Protein-Casein/Whey ratio			30/70	
Intact protein				

NAN OPTIPRO HA GOLD 1 formula (Ready to Feed)

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	20	67	1.3 g	322
Protein-Casein/Whey ratio			30/70	
Partially Hydrolysed protein				

Preterm Formula Preparations**Aptamil Gold+ Preterm Formula (Ready to Feed)**

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	24	79	2.6 g	375
Protein – Casein/Whey Ratio			38%/62%	
Hydrolysed Protein			No	

S26-Gold Alula LBW RTF Formula (Low Birth Weight Ready to Feed formula)

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	24	80	2.69 g	
Protein-Casein/Whey ratio			40%/60%	
Hydrolysed protein			No	

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FORMULA PREPARATIONS IN NEWBORN CARE CENTRE cont'd**PreNAN RTF formula (Ready to Feed)**

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
	24	80	2.9 g	308
Protein-Casein/Whey ratio			100% whey	
Partially Hydrolysed protein				

Semi-Elemental formulas**Pepti-Junior – Semi-elemental formula**

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
Standard: 1 scoop to 30 mL	20	66	1.8 g	210
1 scoop to 27 mL	22	74	2.0 g	N/A
1 scoop to 25 mL	24	79	2.2 g	N/A
1 scoop to 22 mL	27	90	2.5 g	N/A
1 scoop to 20 mL	30	99	2.7 g	N/A

*1 scoop = 4.3 g

Alfare – Semi-elemental Formula

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
Standard: 1 scoop to 30 mL	20	67	2.0	217
1 scoop to 27 mL	22	75	2.2	N/A
1 scoop to 25 mL	24	81	2.4	N/A
1 scoop to 22 mL	27	92	2.7	N/A
1 scoop to 20 mL	30	101	3.0	N/A

*1 scoop = 4.5 g.

Elemental Formulas**Neocate – Full elemental aminoacid formula**

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
Standard: 1 scoop to 30 mL	20	67	1.9	340
1 scoop to 27 mL	22	75	2.1	380
1 scoop to 25 mL	24	81	2.3	410
1 scoop to 22 mL	27	92	2.6	470
1 scoop to 20 mL	30	101	2.9	530

*1 scoop = 4.6 g

Elecare – Full elemental aminoacid formula

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL [#]	Osmolality, mOsm/kg
Standard: 1 scoop to 60 mL	20	68	2.2	309
1 scoop to 55 mL	22	75	2.4	N/A
1 scoop to 50 mL	25	82	2.7	N/A
1 scoop to 45 mL	27	91	2.9	N/A
1 scoop to 40 mL	29	95	3.3	N/A

*1 scoop = 9.4 g. [#]Protein equivalents.

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Alfamino – Full elemental aminoacid formula

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL [#]	Osmolality, mOsm/kg
Standard: 1 scoop to 30 mL	21	70	1.9	320
1 scoop to 26 mL	24	81	2.2	N/A
1 scoop to 22 mL	28	88	2.6	N/A
1 scoop to 20 mL	30	100	2.9	N/A

*1 scoop = 4.6 g. #Protein equivalents. Each 100 ml standard preparation contains 1.9 g protein, 7.9 g carbohydrate and 3.4 g fat.

Other special formulas

Monogen – Used in chylothorax, intestinal lymphagiectasia, Long Chain Fatty Acid Oxidation defects (LCHADs), primary hypolipoproteinemia Type 1, severe intestinal malabsorption with steatorrhea. Special formula with whey protein and high Medium Chain Triglycerides (MCT) as fat. Long chain triglycerides are low.

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
Standard: 1 scoop to 30 mL	22.5	75	2.4 g	235
1 scoop to 25 mL	27	89	2.9 g	N/A
1 scoop to 22 mL	30	102	3.3 g	N/A

*1 scoop = 5.6 g. Each 100 ml standard preparation contains 2.4 g protein, 11.6 g carbohydrate, 2.2 g fat and 1.6 mmol Na.

Locasol – Used in hypercalcemia Almost no calcium in the preparation. Always discuss with Endocrinologist prior to commencing this formula.

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
Standard: 1 scoop to 30 mL	20	66	1.9 g	310
1 scoop to 25 mL	24	79	2.3 g	N/A
1 scoop to 22 mL	27	90	2.6 g	N/A

*1 scoop = 4.4 g. Each 100 ml standard preparation contains 1.9 g protein, 7 g carbohydrate, 3.4 g fat, 1.2 mmol Na, <0.5 mmol Ca and 1.5 mmol Phosphate.

Kindergen – Special formula for infants in renal failure. Low potassium, calcium, phosphorus and vitamin A in the preparation. Please note: Standard preparation is 30 kcal/30 mL. Always discuss with renal team prior to commencing this formula. Contains low calcium, phosphorus and Vitamin A and needs closer monitoring for any deficiencies.

Strength	Kcal/30 mL	Kcal/100 mL	Protein, g/100 mL	Osmolality, mOsm/kg
1 scoop to 33 mL	20	66	1.0g	
1 scoop to 30 mL	22	73	1.1g	
1 scoop to 28 mL	24	80	1.2g	
1 scoop to 21 mL	30	101	1.5 g	215

*1 scoop = 5 g. Each 100 ml standard preparation contains 1.5 g protein, 11.8 g carbohydrate, 5.3 g fat, 2 mmol Na, 0.62 mmol K, 0.56 mmol Ca and 0.60 mmol Phosphate.

5. DOCUMENTATION

- eMR
- Fluid Chart
- NICUS database
- Medication chart for Beneprotein

FORMULA PREPARATIONS IN NEWBORN CARE CENTRE cont'd

6. EDUCATIONAL NOTES

- Definitions:¹
 - Solute – A substance that is dissolved in a liquid (solvent) to form a solution.
 - Osmole – A unit of osmotic pressure equivalent to the amount of solute that dissociates in solution to form one mole of particles.
 - Osmolality – The concentration of a solution in terms of osmoles of solute per kilogram of solvent.
 - Osmolarity – The concentration of a solution in terms of osmoles of solute per litre of solution.
- In 1976, the American Academy of Pediatrics (AAP) recommended that the osmolarity of infant formula should not exceed 400 mOsm/l. This was a consensus view and not based on any strong evidence.² However, osmolarity is difficult to measure since the volume of solution changes with the amount of solute added as well as with changes in temperature and pressure. Osmolality is easier to evaluate and is more commonly used because the amount of solvent will remain constant regardless of changes in temperature and pressure.
- Currently, the standard measurement of feed concentration is osmolality. Historical consensus view is that the osmolality of enteral feeds should not exceed 450 mOsm/kg (which approximates to an osmolarity of 400 mOsm/L).
- Average osmolality of human milk is 281-297 mOsm/kg H₂O.
- Formula preparations and the addition of human milk fortifiers have higher osmolality than unfortified human milk.^{3,4} However, all these preparations in common use have osmolality below 450 mOsm/kg. The normal physiological response to an increase in osmolality is to delay gastric emptying and allow dilution of the contents with hypo-osmolar gastric and intestinal secretions.¹
- Average osmolalities of feeds:¹

Enteral feeds	Osmolality (mOsm/kg H ₂ O)
Preterm Human milk	276
Term Human milk	300
Human milk with Nutricia Breast Milk Fortifier	450
Preterm Aptamil Gold Ready to Feed Formula	375
Term Aptamil Gold Ready to Feed Formula	315
Peptijunior – Semi elemental Formula	210
Alfare – Semi elemental Formula	217
Neocate – Full elemental formula	340
Elecare – Full elemental Formula	309
Alfamino – Full elemental Formula	320
Locasol formula	310
Kindergen	215

- Protein content is variable in human milk with a significant decline from transitional milk to mature milk [(1.9 g/100 ml (2.8 g/100 kcal) in preterm transitional 6-10 days milk; 1.5 g/100 ml (2.2 g/100 kcal) in preterm mature 22-30 days; 1.2 g/100 ml (1.9 g/100 kcal) in term mature ≥30 days).⁵ The average protein content of human milk is 1.1 g/100 ml (1.7 g/100 kcal).⁶
- Semi-elemental formulas contain extensively hydrolysed whey protein. Examples are Pepti-junior and Alfare. Semi-elemental (oligomeric) formulas contain peptides of varying chain length, simple sugars, glucose polymers or starch and fat, primarily as medium chain triglycerides (MCT).
- Elemental (monomeric) formulas contain individual amino acids, glucose polymers, and fats with only about 2% to 3% of calories derived from long chain triglycerides (LCT).

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- Neonatal Nursing Guidelines – Human Milk Fortification – Preparation
- Neonatal Medical Guidelines - Enteral Nutrition – preterm infants 1000g and under
- Neonatal Medical Guidelines - Enteral Nutrition – preterm infants 1001-1500g
- Neonatal Medical Guidelines - Enteral Nutrition – preterm infants 1501-1800g
- Neonatal Medical Guidelines - Enteral Nutrition – infants greater than 1800g

8. RISK RATING

- Low

9. NATIONAL STANDARD

- Standard 1 Clinical Governance
- Standard 2 Partnering with Consumers
- Standard 5 Comprehensive Care

10. ABBREVIATIONS AND DEFINITIONS OF TERMS

NCC	Newborn Care Centre	EBM	Expressed Breast milk
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11. REFERENCES

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12. AUTHOR

Primary	26.6.2017	S Bolisetty (lead clinician), E Jozsa (CNE)
Revised	6.3.2018	S Bolisetty (lead clinician), E Jozsa (CNE), J Menzies (RN)

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