PN Guidelines

Appendices

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Appendix 1.0

Nutritional content of SMOF lipid solution vs nutrition requirements

Table 1.0:
Nutritional content of SMOF lipid solution with comparison to micronutrient requirements for PRETERM infants*

SMOF Lipid Volume	0.25ml/kg/hour (6ml/kg/day)	0.5ml/kg/hour (12ml/kg/day)	0.75ml/kg/hour (18ml/kg/day)	Requirements for preterm infants /kg (ESPGHAN 2018)
Fat g/kg/day	1.0	2.0	~3.0	-
Solivito N (Water Soluble vitamins)	**0.33ml/kg/day**	**0.66ml/kg/day**	**0.99ml/kg/day**	**-**
Thiamine (B1) mg	0.10	0.20	0.31	0.35 – 0.5
Riboflavin (B2) mg	0.16	0.32	0.49	0.15 – 0.2
Nicotinamide (B3) mg	1.32	2.64	3.96	4 – 6.8
Pyridoxine(B6) mg	0.16	0.32	0.49	0.15 – 0.2
Pantothenate mg	0.54	1.09	1.64	2.5
Biotin ug	1.98	3.96	5.94	5 – 8
Folic acid ug	13.20	26.40	39.60	56
Cyanocobalamin (B12) mg	0.17	0.33	0.50	0.3
Vitamin C mg	3.73	7.46	11.19	15 – 25
Vitlipid N infant (Fat soluble vitamins)	**~1.3ml/kg/day**	**2.62ml/kg/day**	**3.92ml/kg/day**	-
Vitamin A	89.70ug or 299.00iu	180.78ug or 602.60iu	270.48ug or 901.60iu	227 - 455 ug/kg/d or 700 – 1500iu/kg/day
Vitamin D2	1.30ug or 52.00iu	2.62ug or 104.80iu	3.92ug or 156.80iu	80- 400 iu/kg/d or 200 - 1000 iu/d
Vitamin E	0.83 or 0.91iu	1.68mg or 1.83iu	2.51mg or 2.74iu	2.8 - 3.5 mg/kg/d or 2.8 - 3.5 iu/kg/d
Vitamin K	26.00ug	52.40ug	78.40ug	10 ug/kg/d (recommended, but currently not possible)

*exact constituents may vary slightly due to the aseptic department rounding up volumes for preparation

Table 2.0
Nutritional content of SMOF Lipid solution with comparison to requirements for TERM infants*

SMOF Lipid volume	0.25ml/kg/hour (6ml/kg/day)	0.5ml/kg/hour (12ml/kg/day)	0.75ml/kg/hour (18ml/kg/day)	Requirements for Term infants /kg (ESPGHAN 2018)
Fat g/kg/day	1.0	2.0	~3.0	-
Solivito N (Water soluble vitamins)	**0.33ml/kg/day**	**0.66ml/kg/day**	**0.99ml/kg/day**	**-**
Thiamine (B1) mg	0.10	0.20	0.31	0.35 – 0.5
Riboflavin (B2) mg	0.16	0.32	0.49	0.15 – 0.5
Nicotinamide (B3) mg	1.32	2.64	3.96	4 – 6.8
Pyridoxine(B6) mg	0.16	0.32	0.49	0.15 – 0.2
Pantothenate mg	0.54	1.09	1.64	2.5
Biotin ug	1.98	3.96	5.94	5 – 8
Folic acid ug	13.20	26.40	39.60	56
Cyanocobalamin (B12) mg	0.17	0.33	0.50	0.3
Vitamin C mg	3.73	7.46	11.19	15 – 25
Vitlipid N infant (Fat soluble vitamins)	**~1.3ml/kg/day**	**2.62ml/kg/day**	**3.92ml/kg/day**	-
Vitamin A	89.70ug or 299.00iu	180.78ug or 602.60iu	270.48ug or 901.60iu	150 - 300 ug/kg/d (2300iu/day i.e., NOT per kg)
Vitamin D2	1.30ug or 52.00iu	2.62ug or 104.80iu	3.92ug or 156.80iu	400 iu/kg/d or 40 - 150 iu/kg/d
Vitamin E	0.83 or 0.91iu	1.68mg or 1.83iu	2.51mg or 2.74iu	2.8 - 3.5 mg/kg/d or 2.8 - 3.5 iu/kg/d
Vitamin K	26.00ug	52.40ug	78.40ug	10 ug/kg/d (recommended, but currently not possible)

*exact constituent may vary slightly due to the aseptic department rounding up volumes for preparation

Appendix 2.0

Nutritional content of aqueous PN solutions

Table 3.0: Totals per 100ml of Aqueous PN only

	Sodium free bag 10%	Standard bag 12.5%	Central bag 16%
Protein (g)	2.27	2.88	3.1
Amino Acid (g)	2.56	3.2	3.4
Nitrogen (g)	0.36	0.46	0.5
Sodium (mmol)	0	3.2	4.0
Potassium (mmol)	1.62	1.31	0
Phosphate (mmol)	0.6	1.62	0.8
Calcium (mmol)	0.6	1.62	0.8
Magnesium (mmol)	0.17	0.17	0.2
Glucose (g)	10	12.5	16
Energy (kcal)	49	62	76

Note Peditrace is also added to the aqueous solution to provide trace elements:

- Zinc
- Manganese
- Copper
- Selenium
- Fluoride
- Iodide

Appendix 3.0 Nutrition Requirements

Table 4.0 Summary of ESPGHAN 2018 Vs NICE 2020
Parenteral requirements for PRETERM infants

	Preterm PN requirements	
	NICE 2020	**ESPGHAN 2018**
Energy Kcal/kg/day		
Starting dose	40 – 60	45 – 55
Starting dose if > 4 days after birth	75 – 120	-
Maintenance dose	75 – 120 (Gradually increase e.g., over 4 days)	90- 120 (Increase gradually)
Amino acids g/kg/day (Protein g/kg/day)		
Starting dose	1.5 – 2 (1.35 – 1.8)	1.5 minimum (1.35)
Starting dose if > 4 days after birth	3.0 – 4.0 (2.7 – 3.6)	-
Maintenance dose	3.0 -4.0 (2.7 – 3.6) (Gradually increase e.g., over 4 days)	2.5 -3.0 (2.25 – 3.15) (Gradually increase)
Glucose g/kg/day		
Starting dose	6-9	5.8 – 11.5
Starting dose if > 4 days after birth	9 – 16	-
Maintenance dose	9-16 Gradually increase (e.g., over 4 days)	11.5 – 14.4 (Min 5.8 and max 17.3)
Fat (g/kg/day)		
Starting dose	1.0 -2.0	Not specified
Starting dose if > 4 days after birth	2.5 – 3.0	-
Maintenance dose	3.0 - 4.0 (Gradually increase to this e.g., in increments of 0.5 – 1.0)	4.0 max
Calcium (mmol/l/day)		
Starting dose	0.8 – 1.0 (If starting PN in the first 48 hours after birth)	0.8 – 1.0
Maintenance dose	Increase to 1.5 – 2.0 after 48 hours	1.6 – 3.5
Phosphate (mmol/l/day)		
Starting dose	1.0 (If starting PN in the first 48 hours after birth)	1.0 – 2.0
Maintenance dose	Increase to 2.0 after 48 hours if starting at 1.0	1.6 – 3.5

Table 5.0: Summary of ESPGHAN 2018 Vs NICE 2020
Parenteral requirements for TERM infants

	TERM PN requirements	
	NICE 2020	**ESPGHAN 2018**
Energy Kcal/kg/day		
Starting dose	40 – 60	45 – 50
Starting dose if > 4 days after birth	75 – 120	
Maintenance dose	75 – 120 (Gradually increase e.g., over 4 days)	75 – 85
Amino acids g/kg/day (Protein g/kg/day)		
Starting dose	1-2 (0.9 – 1.8)	1.5 (1.35)
Starting dose if > 4 days after birth	2.5 – 3 (2.25 – 2.7)	-
Maintenance dose	2.5 -3.0 (2.25 – 2,7) (Gradually increase e.g., over 4 days)	1.5 – 3.0 (1.35 – 2.7)- NEWBORN 1.0 – 2.5 (0.9 – 2.25) - (1mth–3yrs)
Glucose g/kg/day		
Starting dose	6-9	3.6 – 7.2
Starting dose if > 4 days after birth	9 – 16	-
Maintenance dose	9-16 Gradually increase (e.g., over 4 days)	8.6 – 14
Fat g/kg/day		
Starting dose	1.0 -2.0	Not specified
Starting dose if > 4 days after birth	2.5 – 3.0	-
Maintenance dose	3.0 - 4.0 (Gradually increase to this e.g., in increments of 0.5 – 1g/kg/day)	Max 4.0
Calcium mmol/l/day (0- 6 months)		
Starting dose	0.8 – 1.0 (If starting PN in the first 48 hours after birth)	-
Maintenance dose	Increase to 1.5 – 2.0 after 48 hours	0.8 – 1.5
Phosphate mmol/l/day (0- 6 months)		
Starting dose	1.0 (If starting PN in the first 48 hours after birth)	-
Maintenance dose	Increase to 2.0 after 48 hours if starting at 1.0	0.7 – 1.3

Appendix 4.0

Nutritional content of example PN prescription volumes for PRETERM INFANTS

Table 6.0: Nutritional Content Vs requirements for PRETERM INFANTS using the STANDARD (12.5%) bag given at standardised fluid volumes for >=750g – 1500g Birth weight

	NICE 2020 Starting dose Nutrition Req (Unless stated)	Day 1	Day 2	Day 3	Day 4	NICE 2020 Full Nutrition Req (unless stated)
Aqueous vol (ml/kg)		63	88	107	125	
SMOF lipid solution vol ml/kg		12	12	18	18	
Total vol ml/kg		**75**	**100**	**125**	**143**	
Protein g/kg/day	1.35 – 1.8	1.8 (7.5kcal/kg)	2.4 (~10kcal/kg)	3.0 (12kcal/kg)	3.6 (14 kcal/kg)	2.7 – 3.6
Amino Acid g/kg/day	1.5 – 2.0	2.0	2.6	3.3	4.0	3.0 – 4.0
Sodium mmol/kg/day	0 – 2.0 (ESPGHAN 2018)	2.0	2.6	3.3	4.0	2.0 – 5.0 (ESPGHAN 2018)
Potassium mmol/kg/day	0 – 3.0 (ESPGHAN 2018)	0.82	1.07	1.36	1.62	2.0 – 3.0 (ESPGHAN 2018)
Phosphate mmol/kg/day	1.0 (NICE 2020) 1.0 – 2.0 (ESPGHAN 2018)	1.0	1.33	1.68	2.0	2.0 (NICE 2020) 1.6 – 3.5 (ESPGHAN 2018)
Calcium mmol/kg/day	0.8 – 1.0 (NICE 2020) 0.8 – 2.0 (ESPGHAN 2018)	1.0	1.33	1.68	2.0	1.5 – 2.0 (NICE 2020) 1.6 – 3.5 (ESPGHAN 2018)
Magnesium mmol/kg/day	0.1 – 0.2 (ESPGHAN 2018)	0.1	0.14	0.18	0.21	0.2 – 0.3 (ESPGHAN 2018)
Glucose 12.5% g/kg/day	6.0 – 9.0	7.9 (32kcal/kg)	10.25 (41kcal/kg)	13.0 (52kcal/kg)	15.5 (62kcal/kg)	9 – 16
Fat g/kg/day	1.0 – 2.0	2.0 (~20kcal/kg)	2.0 (~20kcal/kg)	3.0 (30kcal/kg)	3.0 (30kcal/kg)	3 – 4
NON-PROTEIN energy Kcal/kg/day	-	52	61	82	92	-
Non protein energy per g Amino acid	20 – 30	26	27	26	23	20 – 30
Proportion of fat energy from non-protein energy %	25 – 40	38	33	37	33	25 – 40
Proportion of carbohydrate energy from non-protein energy %	60 – 75	62	67	63	67	60 – 75
Total Energy Kcal/kg/day	40 – 60	60	71	94	106	**75 – 120**

Table 7.0: Nutritional Content Vs requirements for PRETERM INFANTS: using the STANDARD (12.5%) bag given at standardised fluid volumes for >1500g Birth weight

	NICE 2020 Starting dose Nutrition Req (Unless stated)	Day 1	Day 2	Day 3	Day 4	Day 5	NICE 2020 Full Nutrition Req (unless stated)
Aqueous vol (ml/kg)		48	68	82	100	125	
SMOF lipid solution vol ml/kg		12	12	18	18	18	
Total vol ml/kg		**60**	**80**	**100**	**118**	**143**	
Protein g/kg/day	1.35 – 1.8	1.4 (~6 kcal/kg)	2.0 (8 kcal/kg)	2.4 (~10 kcal/kg)	2.9 (~12kcal/kg)	3.6 (14 kcal/kg)	2.7 – 3.6
Amino Acid g/kg/day	1.5 – 2.0	1.6	2.4	2.7	3.25	4.0	3.0 – 4.0
Sodium mmol/kg/day	0 – 2.0 (ESPGHAN 2018)	1.54	2.2	2.6	3.2	4.0	2.0 – 5.0 (ESPGHAN 2018)
Potassium mmol/kg/day	0 – 3.0 (ESPGHAN 2018)	0.63	0.9	1.1	1.3	1.62	2.0 – 3.0 (ESPGHAN 2018)
Phosphate mmol/kg/day	1.0 (NICE 2020) 1.0 – 2.0 (ESPGHAN 2018)	0.78	1.1	1.33	1.62	2.0	2.0 (NICE 2020) 1.6 – 3.5 (ESPGHAN 2018)
Calcium mmol/kg/day	0.8 – 1.0 (NICE 2020) 0.8 – 2.0 (ESPGHAN 2018)	0.78	1.1	1.33	1.62	2.0	1.5 – 2.0 (NICE 2020) 1.7 – 3.5 (ESPGHAN 2018)
Magnesium mmol/kg/day	0.1 – 0.2 (ESPGHAN 2018)	0.08	0.12	0.14	0.17	0.21	0.2 – 0.3 (ESPGHAN 2018)
Glucose 12.5% g/kg/day	6.0 – 9.0	6.0 (24kcal/kg)	8.5 (34 kcal/kg)	10.25 (41kcal/kg)	12.5 (50kcal/kg)	15.5 (62kcal/kg)	9 - 16
Fat g/kg/day	1.0 – 2.0	2.0 (20kcal/kg)	2.0 (20 kcal/kg)	3.0 (30 kcal/kg)	3.0 (30 kcal/kg)	3.0 (30 kcal/kg)	3 – 4
NON-PROTEIN energy Kcal/kg/day	-	44	54	71	80	92	-
Non protein energy per g Amino acid	20 – 30	27.5	22.5	26	25	23	20 - 30
Proportion of fat energy from non-protein energy %	25 – 40	45	37	42	38	33	25 - 40
Proportion of carbohydrate energy from non-protein energy %	60 – 75	55	63	58	62	67	60 - 75
Total Energy Kcal/kg/day	40 – 60	50	62	81	92	106	75 - 120

Table 8.0: Central bag – 16% Glucose - given at maximum volume of 125ml/kg (including lipid) for *PRETERM INFANTS* Vs preterm nutritional requirements

	Aiming for 120ml/kg	NICE 2020 Full Nutrition Requirements (unless stated)
Aqueous vol (ml/kg)	100	
SMOF lipid solution vol ml/kg	18	
Total vol ml/kg	**118**	
Protein g/kg/day	3.1 (~12kcal/kg)	2.7 – 3.6
Amino Acid g/kg/day	3.47	3.0 – 4.0
Sodium mmol/kg/day	4.0	2.0 – 5.0 (ESPGHAN 18)
Potassium mmol/kg/day	0	2.0 – 3.0 (ESPGHAN 18)
Phosphate mmol/kg/day	0.8	2.0 (NICE 2020) 1.6 – 3.5 (ESPGHAN 18)
Calcium mmol/kg/day	0.8	1.5 – 2.0 (NICE 2020) 1.8 – 3.5 (ESPGHAN 18)
Magnesium mmol/kg/day	0.2	0.2 – 0.3 (ESPGHAN 18)
Glucose 16% g/kg/day	16 (64kcal/kg)	9 – 16
Fat g/kg/day	3.0 (30 kcal/kg)	3 – 4
NON-PROTEIN energy Kcal/kg/day	94kcal/kg	-
Non protein energy per g Amino acid	27	20 – 30
Proportion of fat energy from non-protein energy %	32	25 – 40
Proportion of carbohydrate energy from non- protein energy %	65	60 – 75
Total Energy Kcal/kg/day	106	75 – 120

Table 9.0: Sodium Free bag - 10% glucose nutritional content Vs preterm infant requirements

- This is an example of nutritional content with standard fluid increments
- This bag is likely to be used mostly for the first 48 hours after birth for < 28/40 infants - it is not formulated to be used for much longer than this.

	NICE 2020 Starting dose Nutrition requirements (Unless stated)	Day 1	Day 2	Day 3 (if needed)	NICE 2020 Full Nutrition Requirements (unless stated)
Aqueous vol (ml/kg)		78	108	132	
SMOF lipid solution vol ml/kg		12	12	18	
Total vol ml/kg		**90**	**120**	**150**	
Protein g/kg/day	1.35 – 1.8	1.78 (7.1 kcal/kg)	2.45 (9.8kcal/kg)	3.0 (12kcal/kg)	2.7 – 3.6
Amino Acid g/kg/day	1.5 – 2.0	2.0	2.7	3.26	3.0 – 4.0
Sodium mmol/kg/day	0 – 2.0 (ESPGHAN 2018)	0	0	0	2.0 – 5.0 (ESPGHAN 18)
Potassium mmol/kg/day	0 – 3.0 (ESPGHAN 18)	1.26	1.75	2.14	2.0 – 3.0 (ESPGHAN 18)
Phosphate mmol/kg/day	1.0 (NICE 2020) 1.0 – 2.0 (ESPGHAN 18)	0.47	0.65	0.79	2.0 (NICE 2020) 1.6 – 3.5 (ESPGHAN 18)
Calcium mmol/kg/day	0.8 – 1.0 (NICE 2020) 0.8 – 2.0 (ESPGHAN 18)	0.47	0.65	0.79	1.5 – 2.0 (NICE 2020) 1.9 – 3.5 (ESPGHAN 18)
Magnesium mmol/kg/day	0.1 – 0.2 (ESPGHAN 18)	0.13	0.18	0.22	0.2 – 0.3 (ESPGHAN 18)
Glucose 10% g/kg/day	6.0 – 9.0	7.8 (31.2kcal/kg)	10.8 (44kcal/kg)	13.2 (52.8kcal/kg)	9 – 16
Fat g/kg/day	1.0 – 2.0	2.0 (20kcal/kg)	2.0 (20kcal/kg)	3.0 (30kcal/kg)	3 – 4
NON-PROTEIN energy Kcal/kg/day	-	51.2	64	82.8	-
Non protein energy per g Amino acid	20 – 30	25.6	23.7	25.4	20 – 30
Proportion of fat energy from non-protein energy %	25 – 40	39	31	36	25 – 40
Proportion of carbohydrate energy from non- protein energy %	60 – 75	61	69	64	60 – 75

Total Energy Kcal/kg/day	40 – 60	58.3	73.8	94.8	75 – 120

Appendix 5.0

Nutritional content of example PN prescription volumes for TERM INFANTS

Table 10.0: Nutritional Content Vs requirements for *TERM INFANTS (First month of life)*: using 12.5% bag given at standardised fluid volumes for >1500g Birth weight

	NICE 2020* Starting dose Nutrition Req (Unless stated	Day 1	Day 2	Day 3 Onwards	ESPGHAN 2018 Full Nutrition Require-ments (Unless stated)
Aqueous vol (ml/kg)		48	68	82	
SMOF lipid solution vol ml/kg		12	12	18	
Total vol ml/kg		**60**	**80**	**100**	
Protein g/kg/day	0.9 – 1.8	1.4 (~6 kcal/kg)	2.0 (8 kcal/kg)	2.4 (~10 kcal/kg)	1.25 - 2.5
Amino Acid g/kg/day	1 - 2	1.6	2.4	2.9	1.5 – 3.0
Sodium mmol/kg/day	0 – 2.0 ESPGHAN 2018	1.54	2.2	2.6	2.0 – 3.0
Potassium mmol/kg/day	0 – 3.0 ESPGHAN 2018	0.63	0.9	1.1	1.5 – 3.0
Phosphate mmol/kg/day	1.0	0.78	1.1	1.33	0.7 – 1.3 (0 – 6months)
Calcium mmol/kg/day	0.8 – 1.0	0.78	1.1	1.33	0.8 – 1.5 (0 – 6 months)
Magnesium mmol/kg/day	0.1 – 0.2 (0 – 6 months) (No starting dose)	0.08	0.12	0.14	0.1 – 0.2 (0 – 6 months)
Glucose 12.5% g/kg/day	6 -9	6.0 (24 kcal/kg)	8.5 (34 kcal/kg)	10.25 (41kcal/kg)	7.2 – 14.4
Fat g/kg/day	1 - 2	2.0 (20kcal/kg)	2.0 (20 kcal/kg)	3.0 (30 kcal/kg)	4.0 max
NON-PROTEIN energy Kcal/kg/day		44	54	71	-
Non protein energy per g Amino acid	20 – 30 (NICE 2020)	27.5	22.5	26	20 – 30 (NICE 2020)
Proportion of fat energy from non-protein energy %	25 – 40 (NICE 2020)	45	37	42	25 – 40 (NICE 2020)
Proportion of carbohydrate	60 – 75 (NICE 2020)	55	63	58	60 – 75 (NICE 2020)

energy from non-protein energy %					
Total Energy Kcal/kg/day	45 - 50	50	62	81	75 - 85

**ESPGHAN doesn't set starting requirements for term*

Table 11.0: Central bag - 16% Glucose bag showing ESPGHAN 2018 and NICE 2020 nutritional requirements comparison for term infants
NB. Suggested standard aim of 100ml/kg/day with lipid added for *TERM INFANTS*

	Aim for 100ml/kg 16% bag	ESPGHAN 2018 Full Nutrition Requirements for term infant	NICE 2020 Full nutrition requirements for term infant
Aqueous vol (ml/kg)	82		
SMOF lipid solution vol ml/kg	18		
Total vol ml/kg	**100**		
Protein g/kg/day	2.5 (10kcal/kg)	1.25 - 2.5	2.2 – 2.7
Amino Acid g/kg/day	3.0	1.5 – 3.0	2.5 – 3.0
Sodium mmol/kg/day	3.2	2.0 – 3.0	-
Potassium mmol/kg/day	0	1.5 – 3.0	-
Phosphate mmol/kg/day	0.64	0.7 – 1.3 (0 – 6months)	2.0
Calcium mmol/kg/day	0.64	0.8 – 1.5 (0 – 6 months)	1.5 – 2.0
Magnesium mmol/kg/day	0.16	0.1 – 0.2 (0 – 6 months)	
Glucose g/kg/day	12.8 (51kcal/kg)	7.2 – 14.4	9.0 – 16.0
Fat g/kg/day	3.0 (30 kcal/kg)	4.0 max	3 – 4
NON-PROTEIN energy Kcal/kg/day	81 kcal/kg	-	-
Non protein energy per g Amino acid	27	-	20 – 30 (NICE 2020)
Proportion of fat energy from non-protein energy %	37	-	25 – 40 (NICE 2020)
Proportion of carbohydrate energy from non- protein energy %	63	-	60 – 75 (NICE 2020)
Total Energy Kcal/kg/day	91	75 - 85	75 – 120

Key References:

- Bronsky J, et al. (2018) ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Vitamins, *Clinical Nutrition*. Pp2366 – 2378. Available at ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Vitamins (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Domellof M, et al. (2018) ESPGHAN/ESPEN/ESPR guidelines on pediatric parenteral nutrition: Iron and trace minerals, *Clinical Nutrition*. Pp2354 – 2359. Available at ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Iron and trace minerals (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Jochum F, et al. (2018) ESPGHAN/ESPEN/ESPR guidelines on pediatric parenteral nutrition: Fluid and electrolytes, *Clinical Nutrition* .pp 2344 – 2353. Available at ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Fluid and electrolytes (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Joosten K, et al. (2018) ESPGHAN/ESPEN/ESPR guidelines on pediatric parenteral nutrition: Energy, *Clinical Nutrition* . ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Energy (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Lapillonne A, et al. (2018) ESPGHAN/ESPEN/ESPR guidelines on pediatric parenteral nutrition: Lipids, *Clinical Nutrition*. ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Lipids (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Mesotten D, et al. (2018) ESPGHAN/ESPEN/ESPR guidelines on pediatric parenteral nutrition: Carbohydrates, *Clinical Nutrition*. ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Carbohydrates (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Mihatsch W, et al. (2018) ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Calcium, phosphorus and magnesium, *Clinical Nutrition*. ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Carbohydrates (clinicalnutritionjournal.com) (Accessed 14/01/2022)

- Mulholland, P et al (June 2021) MCN for Neonatology West of Scotland Neonatal Guideline. Parenteral Feeding of preterm and term Infants

- National Institute for health and Care excellence NG154 (2018) Neonatal Parenteral Nutrition, Available at https://www.nice.org.uk/guidance/NG154 (Accessed 14/01/2022)

- Van Goudoever JB, et al. (2018) ESPGHAN/ESPEN/ESPR guidelines on pediatric parenteral nutrition: Amino acids, *Clinical Nutrition*. ESPGHAN/ESPEN/ESPR/CSPEN guidelines on pediatric parenteral nutrition: Amino acids (clinicalnutritionjournal.com) (Accessed 14/01/2022)