

Consensus Clinical Guidelines for Late Preterm Infant (LPI) Feeding UCSF Multi-Site Neonatology Collaboration

- **Goal**
 - Encourage and support human milk feeding with goal of exclusive breastfeeding for all LPIs.
 - Avoid co-morbidities of LPI associated with inadequate feeding.
 - Provide adequate intake of calories, protein and micronutrients to achieve optimal growth.
- **Criteria for Use of LPI Feeding Guideline**
 - Infants born at 34 0/7 to 36 6/7 weeks gestational age (GA)
 - Absence of severe congenital anomaly, need for critical care intervention, or contraindication for enteral feeding
 - Absence of contraindication for use of maternal breast milk (MBM)
- **Support for Breastfeeding**
 - **Skin-to-Skin:** Provide opportunity for skin-to-skin time after birth in all late preterm infants who are clinically stable and maternal post-partum status permits. Encourage first breastfeeding attempt within first hour after birth if possible.
 - Resource-intensive but many maternal & neonatal benefits (e.g. neonatal glucose stability)
 - **Lactation Consultation:** Should be offered to ALL mothers of late preterm infants.
 - Encourage breastfeeding attempts q 2–3 hours (8–12 times / 24 hour period), for 15–20 minutes / session
 - Mothers may skip a few breastfeeding / pumping sessions per 24 hour period in order to obtain sufficient rest
 - **Milk Expression:** Educate & encourage mothers to hand express or pump at least 8 times / 24 hour period, for 10-20 minutes / session
 - All LPIs (34-36wks): initiate milk expression within 4 hours after birth
 - **Assessment of Breast Milk Transfer (for infants receiving supplementation):**
 - Latch scoring / subjective nursing and lactation assessment of breastfeeding success
 - After day 3 (or when mother's volume of milk has increased / mother's breasts are softened after feedings), consider weighing diapered infant before and after breastfeeding + subtract transfer amount from the total supplemental feeding guideline for that day
 - **Assessment of Hydration Status:** daily weights, weighing / counting diapers, clinical assessment
 - **Duration of Supplementation:** Supplementation of breastfeeding is needed until LPI can feed effectively, empty mother's breasts, mothers' milk is abundant, and infant is maintaining/gaining weight (lactation specialists may assist with defining "successful / effective breastfeeding")
- **LPI Nutritional Needs / Goals**
 - Estimated Needs:
 - 34-36 wks: 120 kcal/kg/day; 3.1 g prot/kg/day
 - 37-38 wks: 115 kcal/kg/day; 2.5 g prot/kg/day
 - < 3kg: 120-130 kcal/kg/day; >3 g protein/kg/day
 - > 3 kg: 110-120 kcal/kg/day; >2 g protein/kg/day
 - Expected Weight Gain (after diuresis):
 - 34-38 wks: 30-35 g/day
 - 0-3 months CGA: 25-35 g/day
 - 3-6 months CGA: 15-20 g/day

NOTE: For CATCH-UP GROWTH, increase expected weight gain, energy and protein goals by 10-20%

LPI Supplemental Feeding Guidelines

NOTE: an individual infant may be considered in a higher or lower gestational age feeding category based on provider assessment of infant's maturity and clinical status or based on maternal post-partum status

	34 – 34 6/7 weeks		35 – 35 6/7 weeks	36 – 36 6/7 weeks
DEFINITIONS	SGA <1800gm	AGA >1800gm	SGA <2000gm (SEE 34wk AGA) AGA >2000gm	SGA <2200gm (SEE 35wk AGA) AGA >2200gm
ADMISSION	ICN, monitors		<ul style="list-style-type: none"> ○ ICN/SCN, may leave for feedings ○ Transition to rooming in when clinically stable 	Remain with mother, rooming in
ASSESSMENT	Daily: <ul style="list-style-type: none"> • Calculate wt loss from birth • Calculate wt gain once at nadir • Intake and output 			
BREASTFEEDING SUPPLEMENTATION	DAY 1: Initiate breastfeeding, maximize skin-to-skin & maternal-infant bonding time (challenge = physical separation of mother & baby) DAY 2: Supplement ALL infants	DAY 1: Initiate breastfeeding without intervention, maximize skin-to-skin & maternal-infant bonding time Supplement IF: <ul style="list-style-type: none"> • Poor / absent feeding cues (mouthing, rooting, waking for feeds) • Non-vigorous / stress behaviors (As, Bs &Ds, color change, flaccid, hiccups, unable to stay awake to feed) • Hypoglycemia (<50 mg/dl) • Hyperbilirubinemia related to poor intake • Weight loss >3% in 24hrs • Weight loss >5% in 48hrs • Weight loss >7% in 72hrs 		DAY 1: Initiate breastfeeding without intervention, maximize skin-to-skin & maternal-infant bonding time Supplement IF: <ul style="list-style-type: none"> • Poor / absent feeding cues (mouthing, rooting, waking for feeds) • Non-vigorous / stress behaviors (As, Bs &Ds, color change, flaccid, hiccups, unable to stay awake to feed) • Hypoglycemia (<50 mg/dl) • Hyperbilirubinemia related to poor intake • Weight loss >3% in 24hrs • Weight loss >5% in 48hrs • Weight loss >7% in 72hrs
METHOD OF SUPPLEMENTATION	May include supplemental nursing system (SNS), finger feeding (FF), bottle feeding, cup feeding, nasogastric or orogastric tube (NG/OG), IV fluids, parenteral nutrition per hospital policy & staff expertise <ul style="list-style-type: none"> • Non-bottle feeding (SNS/FF) optimal for establishing early breastfeeding; logistics TBD @ each institution 			
RATIONALE FOR SUPPLEMENTATION	<ul style="list-style-type: none"> • 50% require gavage feeds¹ • 51% have feeding problems² • Full feeds by ~10 days of life³ 	<ul style="list-style-type: none"> • 27% require gavage feeds¹ • 34% have feeding problems² • Full feeds by ~6 days of life³ 	<ul style="list-style-type: none"> • 9% require gavage feeds¹ • 22% have feeding problems² • Full feeds by ~3 days of life³ 	

1. Stellwagon, L and Boies E. *CPQCC Care and Management of the Late Preterm Infant Toolkit: Section IV: Nutrition and Feeding of the Late Preterm Infant* February 2013.
2. Lubow et al. *Am J Obstet Gynecol* 2009;20(5):e30-33.
3. Vachharajani & Dawson 2009;48(4):383-388.

NOTE: an individual infant may be considered in a higher or lower gestational age feeding category based on provider assessment of infant's maturity and clinical status or based on maternal post-partum status

	34-34 6/7 wks SGA<1800 g	34-34 6/7 wks AGA >1800 g	35 – 35 6/7 weeks	36 – 36 6/7 weeks
IV CRITERIA: <ul style="list-style-type: none"> • BW <1500gm • Persistent hypoglycemia • IUGR / SGA • Poor feeding cues • Non-vigorous • Parents decline formula 	<ul style="list-style-type: none"> • PIV, UVC or PICC • <u>BW >1500gm:</u> D10W @ 60ml/kg/day • <u>BW <1500gm:</u> TPN • Wean IVF/TPN as increase enteral feeding + stable glucose 	If IVF needed: <ul style="list-style-type: none"> • PIV • D10W @ 60ml/kg/day • Wean IVF as increase enteral feeding + stable blood glucose 	If IVF needed: <ul style="list-style-type: none"> • PIV • D10W @ 60ml/kg/day • Wean IVF as increase enteral feeding + stable blood glucose 	If IVF needed: <ul style="list-style-type: none"> • PIV • D10W @ 60ml/kg/day • Wean IVF as increase enteral feeding + stable blood glucose
NG / OG	Place NG or OG tube if poor / absent feeding cues, non-vigorous, hypoglycemia, or unable to meet volume goals			
TYPE	<ul style="list-style-type: none"> • Expressed breast milk • Preterm Formula 20 kcal/oz 		<ul style="list-style-type: none"> • Expressed breast milk • Preterm Formula 20 kcal/oz 	<ul style="list-style-type: none"> • Expressed breast milk • Standard Term Formula
FORTIFY	Fortify @ 60 ml/kg/day: <ul style="list-style-type: none"> • MBM 24 kcal/oz with HMF • Preterm Formula 24 kcal/oz 		Fortify IF poor intake / poor wt gain at goal volume feeds: <ul style="list-style-type: none"> • MBM 24 kcal/oz with HMF • Preterm Formula 24 kcal/oz 	Fortify IF poor intake / poor wt gain at goal volume feeds: <ul style="list-style-type: none"> • MBM 24 or Term Formula 22/24 kcal/oz • Preterm Discharge Formula (PDF) 22 kcal/oz
SUPPLEMENTAL ENTERAL VOLUMES <i>(NOTE: volumes = total feeding goals; modify volume of supplementation based on assessment of intake from breastfeeding)</i>	<ul style="list-style-type: none"> • DAY 1: breastfeeding ad lib • DAY 2: 20-40 ml/kg/day OR 5-10 ml/feeding • DAY 3: 60-80 ml/kg/day OR 15-20 ml/feeding • DAY 4: 100-120 ml/kg/day OR 20-25 ml/feeding • DAY 5: 140-160 ml/kg/day OR 30-35 ml/feeding • DAY 6 (GOAL – fortified): 160 ml/kg/day OR 35 ml/feeding <p><i>NOTE: Advance supplementation ONLY if feedings are tolerated (heme (-) stools, stable abd girth / no visible bowel loops, residual <1/3 of feed, no persistent emesis)</i></p>		<ul style="list-style-type: none"> • DAY 1: breastfeeding ad lib • DAY 2: 20-40 ml/kg/day OR 5-10 ml/feeding • DAY 3: 60-80 ml/kg/day OR 15-20 ml/feeding • DAY 4: 100-120 ml/kg/day OR 25-30 ml/feeding • DAY 5: 140-160 ml/kg/day OR 35-40 ml/feeding • DAY 6 (GOAL): 160 ml/kg/day OR 35 ml/feeding (fortified) to 180 ml/kg/day OR 45 ml/feeding (unfortified/no BF) <p><i>NOTE: Advance supplementation ONLY if feedings are tolerated (see adjacent box for details)</i></p>	<ul style="list-style-type: none"> • DAY 1: breastfeeding ad lib • DAY 2: 20-40 ml/kg/day OR 5-10 ml/feeding • DAY 3: 60-80 ml/kg/day OR 15-20 ml/feeding • DAY 4: 100-120 ml/kg/day OR 25-30 ml/feeding • DAY 5: 140-160 ml/kg/day OR 40-45 ml/feeding • DAY 6 (GOAL): 160 ml/kg/day OR 45 ml/feeding (fortified) to 180 ml/kg/day OR 50 ml/feeding (unfortified/no BF) <p><i>NOTE: Advance supplementation ONLY if feedings are tolerated (see adjacent box for details)</i></p>

NOTE: an individual infant may be considered in a higher or lower gestational age feeding category based on provider assessment of infant's maturity and clinical status or based on maternal post-partum status

	34 – 34 6/7 weeks	35 – 35 6/7 weeks	36 – 36 6/7 weeks
DISCHARGE READINESS	<ul style="list-style-type: none"> • >48 hrs of successful feeding (8 good feedings/day; feeding volume sufficient) • Weight loss stabilized in infants ≥ 35-36 wks and weight gain demonstrated at goal feedings in infants < 35-36 wks • Temperature stability (≥ 36.5 C) in open crib >24 hrs • Family competent to continue feeding plan (i.e. waking baby if necessary; recognize/respond to early feeding cues) • F/U appointment within 2 days • Discharge lactation plan in place • Nutritional supplements Rx • WIC referral completed PRN 		
DISCHARGE <i>(NOTE: Transition feeding plan 1-2 days prior to nursery discharge)</i>	<p>BREASTFEEDING:</p> <ul style="list-style-type: none"> • Minimum 8-10 feeds/day • BF ad lib + minimum 2 supplemental bottle feedings until 48wks CGA or 12wks post-discharge • Supplemental feeds: MBM 24 OR PDF 24 <p>FORMULA FEEDING:</p> <ul style="list-style-type: none"> • PDF 22 or 24 • Continue PDF 22 or 24 until 48wks CGA or 12wks post-discharge <p>PMD VISITS:</p> <ul style="list-style-type: none"> • Review rate of weight gain and detailed lactation and feeding history; lactation consult/increased supplementation PRN <p>AFTER 12 WEEKS:</p> <ul style="list-style-type: none"> • Review rate of weight gain and catch up growth; if not caught up to >10%ile for length for actual age then consider continued supplementation or PDF 	<p>BREASTFEEDING:</p> <ul style="list-style-type: none"> • Minimum 8-10 feeds/day • BF ad lib + minimum 2 supplemental bottle feedings until 48wks CGA or 12wks post-discharge • Supplemental feeds: MBM 24 OR PDF 24 <p>FORMULA FEEDING:</p> <ul style="list-style-type: none"> • PDF 22 • Continue PDF 22 or 24 until 48wks CGA or 12wks post-discharge <p>PMD VISITS:</p> <ul style="list-style-type: none"> • Review rate of weight gain and detailed lactation and feeding history; lactation consult/ increased supplementation PRN <p>AFTER 12 WEEKS:</p> <ul style="list-style-type: none"> • Review rate of weight gain and catch up growth; if not caught up to >10%ile for length for actual age then consider continued supplementation or PDF 	<p>BREASTFEEDING:</p> <ul style="list-style-type: none"> • Minimum 8-10 feeds/day • BF ad lib • Supplemental feedings (IF needed): <ul style="list-style-type: none"> ○ MBM or Term Formula ○ MBM 24 or PDF 22 (IF used in nursery for poor wt gain) <p>FORMULA FEEDING:</p> <ul style="list-style-type: none"> • Term Formula <p>PMD VISITS:</p> <ul style="list-style-type: none"> • Review rate of weight gain and detailed feeding history; consider lactation consult/ supplementation PRN
GROWTH CHART	WHO plotted for corrected GA <i>IHDP curves NOT recommended</i>	WHO plotted for corrected GA <i>IHDP curves NOT recommended</i>	WHO plotted for corrected GA <i>IHDP curves NOT recommended</i>

Vitamins & Nutritional Supplements

Vitamins / supplements may be started in nursery, at discharge, or as outpatient by 2 weeks of age

Exclusive Breastfeeding & >36 weeks	<ul style="list-style-type: none"> ○ Polyvisol 1ml Qday x 1 50ml bottle, then Vitamin D 400 IU Qday ○ Fe Sulfate 2 mg/kg elemental iron Qday
Supplemented Breastfeeding / Fortified MBM	<ul style="list-style-type: none"> ○ Polyvisol 1ml Qday until 12 months ○ Fe Sulfate 2 mg/kg elemental iron Qday
Term Formula Feeding	<ul style="list-style-type: none"> ○ <2500 grams Polyvisol 1ml Qday x 1 50ml bottle, then Vitamin D 400 IU Qday ○ >2500 grams: Vitamin D 400 IU Qday (D-vi-sol)
PDF 22 kcal/oz Formula Feeding	<ul style="list-style-type: none"> ○ <2500 grams: Polyvisol 1ml Qday x 1 50ml bottle, then Vitamin D 400 IU Qday ○ >2500 grams: Vitamin D 400 IU Qday (D-vi-sol)

Note: 1 ml Poly-vi-sol with iron contains 10 mg iron and no vitamin B12

References

Stellwagon, L and Boies E. *CPQCC Care and Management of the Late Preterm Infant Toolkit: Section IV: Nutrition and Feeding of the Late Preterm Infant* February 2013.

National Perinatal Association *Multidisciplinary Guidelines for Care of the Late Preterm Infant*

SFGH Late Preterm Infant Feeding Guidelines and Algorithm

Bhatia J et al. *Selected Macro/Micronutrient Needs of the Routine Preterm Infant J Pediatr* 2013;162:S48-55.

Lapillonne A et al. *Nutritional Recommendations for the Late-Preterm Infant and the Preterm Infant after Hospital Discharge J pediatr* 2013;162:S90-100.

Danner E et al. *Weight Velocity in Infants and Children Nutr Clin Pract* 2009 24:76-79.

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Brandt I et al. *Catch-up Growth of Supine Length/Height of VLBW, SGA Preterm Infants to Adulthood J Pediatr* 2005;147:662-8.

ADDENDUM 1: Nutrient Analysis

		2.5 kg			
Nutrient	Adequate Intake (per day)	MBM	MBM 24 w/ Neosure	Similac 19	Neosure 22
Volume (ml/kg)	>140	179	150	188	162
Kcal/kg	120	122	120	120	123
Protein (g/kg)	3	1.9	2.1	2.5	3.5
Volume (ml)	180 ml/kg	450	375	450	413
A IU	1320	1013	1077	912	1079
D IU	400	9	46	228	216
E IU	6	1.8	3.5	4.6	11.1
C mg	40	18.4	23.1	33	46.2
B1 mcg	200	95	198	304	539
B2 mcg	300	156	209	456	462
Niacin mcg	2000	677	1617	3193	6010
B6 mcg	100	92	130	182	308
B12 mcg	0.4	0.21	0.39	0.76	1.23
Iron mg	2 mg/kg/d	0.12	1.1	5.47	4.42
Zinc mcg	2 mg	0.55	1.1	2.28	2.94
Ca mg	210 mg	126	160	237	324
P mg	100 mg	64	86	128	191

ADDENDUM 2: Feeding & Supplementation Selection

Feeding Type	Brand Name <i>(NOTE: calories/oz dependent on recipe)</i>	Manufacturer
Human Milk	Maternal Breastmilk (MBM)	Mother
Human Milk Fortifier (HMF)	Similac Liquid HMF	Abbott
	Enfamil Liquid HMF	Mead Johnson
Preterm Formula	Similac Special Care	Abbott
	Premature Enfamil	Mead Johnson
	Gerber Goodstart Premature	Nestle
Preterm Discharge Formula (PDF)	Neosure	Abbott
	Enfacare	Mead Johnson
	Nourish	Nestle
Standard Term Formula	Variety – milk based (Soy formula not recommended for preterm infants)	Abbott / Mead Johnson / Nestle / Private Label