Nourishing the Former Preemie

Nutritional Practices for Preterm Infants Post-NICU and Resources for Local Providers

1

Objectives

- Understand nutritional needs of the preterm infant post-discharge
- Identify duration of expected supplementation
- Examine methods to meet nutritional needs
- Obtain 3 local resources or tools for nutrition

3

Early Brain Development

- Critical developmental window + first 1000 days
  - Growth associated with motor, psychomotor and neurodevelopment[1,2,3]
- Highly metabolic organ (60% total o2 consumption in newborn)
  - Dependent on adequate substrate
- Poor nutrition linked to:
  - Poor immune function
  - Higher risk of NDI
  - Delayed motor/language development
  - Lower IQ

1. Ehrenkranz RA, Younes N, Lemons JA, et al. Longitudinal growth of hospitalized very low birth weight infants. *Pediatrics*. 1999;104(2 Pt 1):280-289. doi:10.1542/peds.104.2.280
2. Ramel SE, Georgieff MK. Preterm nutrition and the brain. *World Rev Nutr Diet*. 2014;110:190-200. doi:10.1159/000358467

5

Growth and Development

Higher weight gain
- Higher cognitive testing scores
- Improved motor development

Lower weight gain
- Higher risk of CP
- Lower neurological and psychomotor testing scores
- Higher risk of re-admission

1. Belfort MB, Rifas-Shiman SL, Sullivan T, et al. Infant growth before and after term: effects on neurodevelopment in preterm infants. *Pediatrics*. 2011;128(4):e899-e906. doi:10.1542/peds.2011-0282
2. Sénès T, Guillot M, Angoa G, Pronovost E, Ndiaye ABKT, Mohamadi I, Simonyan D, Lavoie PM, Synnes A, Marc I; MOBYDick trial group. Does Growth Velocity Affect Associations between Birth Weight and Neurodevelopment for Infants Born Very Preterm? *J Pediatr*. 2023 Sep;260:113531. doi: 10.1016/j.jpeds.2023.113531. Epub 2023 Jun 1. PMID: 37268036.
3. Ehrenkranz RA. Nutrition, growth and clinical outcomes. *World Rev Nutr Diet*. 2014;110:11-26. doi:10.1159/000358455

6

Other Systems

Lungs	Skeletal Mass and Bone Density	GI Tract
• Growing and forming alveoli through about age 8; lung function tied to lean mass growth	• Starts in utero, affected by maternal status as well as early diet • MBD most often happening within 16 weeks	• Human milk supports maturation; not fully mature until ~ age 3

1. Perrone S, Caporilli C, Grassi F, Ferroncio M, Biagi E, Dall'Orto V, Beretta V, Petrolini C, Gambini L, Street ME, Dall'Asta A, Gili T, Esposito S. Prenatal and Neonatal Bone Health: Updated Review on Early Identification of Newborns at High Risk for Osteopenia. Nutrients. 2023 Aug 9;15(16):3515. doi: 10.3390/nu15163515. PMID: 37630700; PMCID: PMC10458154.
2. Rehman S, Bacha D. Embryology. Pulmonary. [Updated 2022 Aug 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK544372/.
3. Hendrickx JOE, Zuallaert RD, Renes IB, van Limpen RA, van Zoeren-Grobben D, Jebbink LEG, Boeren S, van Elburg RM, Knol J, Belzer C. Maturation of the preterm gastrointestinal tract can be defined by host and microbial markers for digestion and barrier defense. Sci Rep. 2021 Jun 17;11(1):12908. doi: 10.1038/s41598-021-92222-y. PMID: 34140588; PMCID: PMC8211692.

7

The Late-Preterm Infant

- Largest population, least studied
- Higher risk compared to term infant
  - Hyperbili
  - Hypoglycemia
  - Poor feeding
  - Hypothermia
  - Readmission
- Individualized discharge needs
- Need more support
  - Frequent follow up
  - **Lactation support**
  - Growth monitoring

1. Lapillonne A, O'Connor DL, Wang D, Rigo J. Nutritional recommendations for the late-preterm infant and the preterm infant after hospital discharge. *J Pediatr*. 2013 Mar;162(3 Suppl):S90-100. doi: 10.1016/j.jpeds.2012.11.058. PMID: 23445854.
2. Lapillonne A, Bronsky J, Campoy C, Embleton N, Fewtrell M, Fidler Mis N, Gerasimidis K, Hojsak I, Hulst J, Indrio F, Mosgaard C, Mosha SI, 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.0000000000002387. PMID: 31356591.

8

Moderately and Extremely Preterm Infant

AGA
- Missed nutrient accretion
- Immature feeding skills
- Reduced energy stores
- Goal is to support growth, may need fortified diet temporarily
- Needs vary based on morbidity and diseases of prematurity

Growth Restricted
- Malnourished at birth, not just small for age
- Multiple etiologies
- + all other challenges of LPI

9

Post-discharge Diet: Breastmilk

- Use of human milk fortifier 12 weeks post discharge
  - Improved linear growth compared to breastfeeding alone
- Not shown to interfere with breastfeeding
- Using powdered formula in breastmilk adds inadequate amounts of protein and minerals
- May need to transition to formula supplementation

11

Post-Discharge Diet: Formula

- Using transitional formula provides better protein, calorie and minerals
- Preterm formula sometimes used short-term in smallest babies
- Can be used along with breastmilk

Dietary Recommendations	Energy kcals/kg	Protein g/kg	Calcium mg/kg	Phosphorous mg/kg
Late-preterm at discharge[1]	115-130	2.5-3.1	70-140	35-90
ELBW/VLBW at discharge[2]	115-130	2.8-3.2	70-140	35-90
*LPI & Term IUGR/SGA at discharge [3, 4]	117-150	2-3.5	70-120	35-75

Discharge Diet options	Energy	Protein	Calcium	Phosphorous
Unfortified breastmilk (BM)	108	1.4	36	21
24-cal BM+Human milk fortifier	128	3.8	113	76
24-cal BM +Neosure	128	1.9	62	35
Neosure 24 kcal	128	3.5	134	80
5 feeds BM, 3 feeds Neosure 24 kcal/oz	115	2.4	85	51

1.Jaquillonee et al. (2014) 2.Groh-Wargo, Thompson & Hovasi Cox (2016),pg 221. 3. Texas Children's Pediatric Handbook. 4. Kesavan et al (2019)pg 403-423

*Estimated based on catch-up growth goal of 0.67 Z-score (5 percentile). Will vary based on degree of growth restriction

12

Length of supplementation

1. Rule of thumb: the earlier they are born, the longer they will need supplementation
2. VLBW/ELBW: at least 6 months to achieve bone density equivalent to newborn & support growth
3. Late-preterm: as needed to support weight gain. Lactation support is vital

13

Vitamin + Minerals

- Vitamin D for all babies until taking about 1 liter per day of formula
  - Mom can high dose ~6500 IU/day if breastfeeding
- Iron
  - Neurodevelopmental detriment with iron deficiency
  - 2-4 mg/kg/day through 12 months corrected age
    - Deficiency will increase needs
    - Should be monitored

1. Hollis BW, Wagner CL, Howard CR, et al. Maternal Versus Infant Vitamin D Supplementation During Lactation: A Randomized Controlled Trial. *Pediatrics*. 2015;136(4):625-634. Pediatrics. 2019 Jul;144(1):e20191063. doi: 10.1542/peds.2019-1063. Erratum for: Pediatrics. 2015 Oct;136(4):625-34. doi: 10.1542/peds. 2015-1669. PMID: 31253738; PMCID: PMC8194461.
2. Gisslen T, Rao R, Georgieff MK. Anemia, Iron Supplementation, and the Brain. Clin Perinatol. 2023 Dec;50(4):853-868. doi: 10.1016/j.clp.2023.07.009. Epub 2023 Aug 31. PMID: 37866852; PMCID: PMC10590989.

15

Standardized Recipes

- Formula compositions vary
- Recipes are designed to be easy to factor up or down
- Estimating amounts (i.e. "just add an extra scoop/packet of HMF")
  - Results in inconsistent measures
  - May be hyperosmolar, too high in protein or certain vitamins
  - Doesn't support caregiver autonomy

18

Recipes

SmartLists

- All formulas, all concentrations
- Breastmilk with all formulas

TEAMS or Email for access

Nichole Cortez
Cortezn@slhs.org
Or any other St.Lukes Peds RD!

19

Local Resources

Outpatient RDN Team & NICU RD team

- Available with referrals
- connect via phone or Epic in-basket

NICU Follow-up clinic

- Highest risk infant enrolled at time of discharge
- Multi-disciplinary team to assess development, growth, and connect with early intervention

WIC

- Income-based eligibility. Medicaid, SNAP, TANFF automatically qualified
  Local address required
- **Signupwic.com**

20

Key Points

Preterm infants need to be followed closely for growth and development

Nutrient deficiencies can have long-term consequences

Preterm infants are at risk of poor nutrition, readmission to hospital, and various morbidities

Diet supplementation after discharge supports growth and nutrient repletion

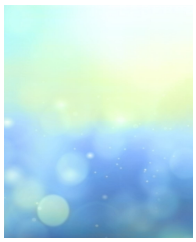
Direct breastfeeding preserves the breastfeeding relationship and a longer duration of breastfeeding

21

Contact

Nichole Cortez

Cortezn@slhs.org
EPIC Inbasket
TEAMS
Voalte
(208) 381-2663



22