

Premature Infants: What do WIC dietitians need to know?



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Physiology and nutritional concerns related to growth and development of the premature infant

Classification of newborn infants

■ Gestation

Preterm	< 37 wk gestation
Term	37-42 wk gestation
Postterm	> 42 wk gestation

■ Birth weight

Low-birth weight	< 2,500 g (5# 8 oz)
Very low birth weight	< 1,500 g (3# 5oz)
Extremely low-birth weight	< 1,000 g (2# 3 oz)
Micropremie	< 750 g (1# 10 oz)

■ Size for gestational age

Small (SGA)	weight < 10 %ile
Appropriate (AGA)	weight \geq 10%ile & \leq 90%ile
Large (LGA)	weight > 90 %ile

Age definitions

- Chronologic or birth age
 - Time since birth
- Gestational age
 - Estimated time since conception;
 - postconceptional age
- Corrected age
 - Age corrected for prematurity

23 week premature infant, AGA,
DOB:2/7/05, birth wt: 574 g(1# 2 oz)
DOL: 9, current wt: 560g.
Corrected age: 24 2/7 wks GA



Some clinical conditions associated with prematurity

- Respiratory distress syndrome which can lead to chronic lung disease
- Frequent infections
- Necrotizing enterocolitis (NEC)
- Osteopenia
- Feeding intolerance
- Uncoordinated suck & swallow
- Malabsorption
- Small gastric capacity



Nutritional implications

- Increased energy, protein and micronutrient needs
- Long-term need for parenteral and enteral nutrition leads to “unlearning how to eat”, infant can also develop oral aversions
- Difficulty tolerating full volume of feedings
- Malabsorption leads to suboptimal intakes
- Difficulty transitioning to feedings by mouth
- Difficulty for mom to maintain breastmilk supply as infant may not breastfeed for weeks or months

Poor bone mass

- Bone mass accretion happens in the third trimester of pregnancy
- TPN is unable to provide sufficient calcium and phosphorus to match in utero bone mass accretion
- Inactivity vs in utero kicking of term infant
- The more premature the more at risk for osteopenia and fractures

Increased energy and protein needs

- Due to clinical instability after birth, optimal kcal. and protein needs may not be delivered for a few days.
- Minimal subcutaneous fat stores, greater body surface area per unit of weight, and higher water content, make temp. control difficult → energy use to produce heat vs growth.
- Rate of growth occurring in the third trimester is faster than postnatal.

Ex.: 1000 g infant gains ~ 18g/d. (+ 13%/wk) vs
3500g infant gains ~30g/d. (+6%/wk).

Impaired growth velocity

Premature infants are at high risk for suboptimal growth due to:

- Frequent sepsis
- Feeding intolerance, therefore suboptimal intake
- Frequent tests during hospital stay, requiring feeds to be placed on hold

Overall, optimal growth is difficult to obtain and many infants are discharged with needs for catch-up growth

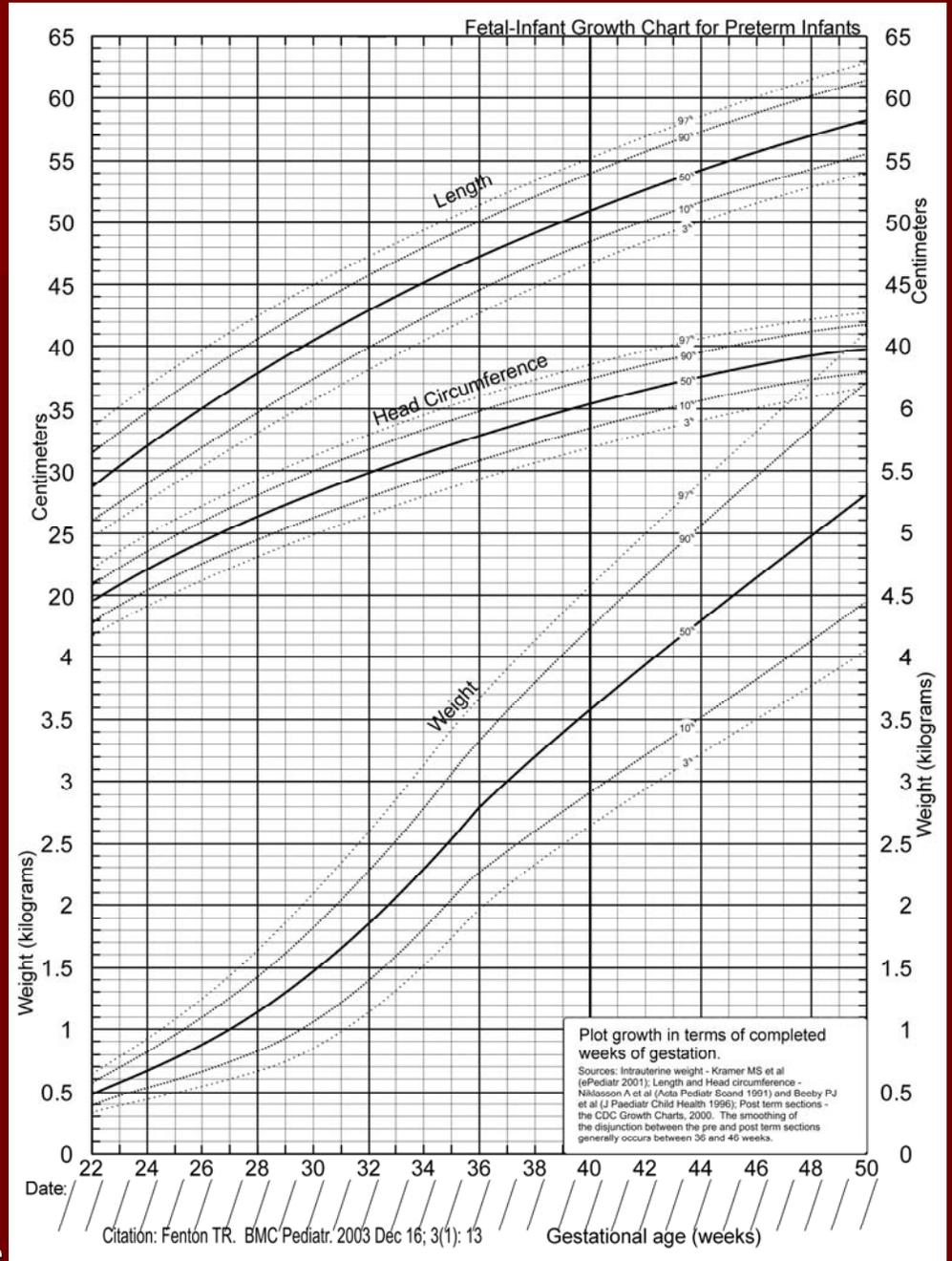
Plotting growth

1. Determine corrected age: current age (wks) + GA -40.

Ex. 15 wks + 32 wks GA -40 = 7 wks

2. If the result is above 0, then a standard growth chart (NCHS) should be used.
3. If the result is below 0 (this infant has not yet reached term age), a premature growth chart should be used.

Fenton growth chart



Expected growth

Age from term (mo)	Weight (oz/wk)	Length (cm/mo)	Head circ. (cm/mo)
1	6–9	3.0-4.5	1.6-2.5
4	3.5–6	2.3-3.6	0.8-1.4
8	3–4	1.0-2.0	0.3-0.8
12	2-3	0.8-1.5	0.2-0.4
18	1 – 2.3	0.7-1.3	0.1-0.4

Infants at Highest Risk for Nutritional Problems

- Infants < 3 lbs 5 oz at birth
- Small-for-gestational age
- Breast-fed infants
- Infants on special formulas
- Infant on parenteral nutrition > 4 wks
- Infants on tube-feedings at home
- Infant < 3rd%ile wt/corrected age at discharge

High risk diagnoses

- Bronchopulmonary Dyplasia
- Chronic Renal Insufficiency
- GI Tract Anomalies
- Congenital Heart Disease
- Malabsorption
- Osteopenia of Prematurity
- Severe Neurological Impairment
- Short Bowel

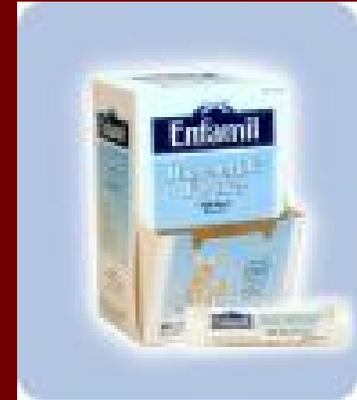
Overview of available Human Milk and Enteral Nutrition Products for the Premature Infants



Breastmilk

Unfortified BM

- Low in protein
- Low in calcium, phosphorus and vit. D
- Not as calorie-dense
- Lower in other micronutrients needed by premature infants.



Fortified BM w/ HMF

- Provides increased protein.
- 2 ½ times more calcium and phosphorus.
- Provides increased amounts of needed micronutrients such as vit. A, D and zinc.

Premature infant formulas

- Similac Special Care (20 and 24), and Premature Enfamil (20 and 24).
- Available only in the hospital
- Higher protein content
- Easier to digest
- Very high in calcium, phosphorus and vitamin content.
- Micronutrient profile to meet the specific needs of premature infants.
- Only used until the infant is 2500-3000 g (5# 8 oz to 6# 9 oz).



Follow-up formulas for infant born < 1850g (4 lbs 1 oz) and <37 weeks' GA

- **Neosure and Enfacare:** Calorie-dense and increased protein (22 kcal/oz)
- Protein, Calcium, Phosphorus ,vit A, vit.D, Zinc and other micronutrient higher than regular formula.
- **Should be used until catch-up growth is achieved, or until 9 mo. to 1 yr corrected age.**
- Powder can also be used to fortify breastmilk



More specialized formulas

Pregestimil, Alimentum, Nutramigen

- Semi-elemental formula, some are high in MCT-oil
- Intolerance, allergies, TPN-cholestasis, s/p NEC, etc.
- Expensive

Neocate

- Elemental formula
- Severe allergies, intolerance, s/p NEC, short gut
- Very expensive

A note on soy formulas:

AAP does not recommend using soy formulas in infant born < 1850g (4 lbs 1oz) or as a prevention of colic or allergy

Pediatrics: 1998:148-153

Feeding expectations for optimal/catch-up growth

Number of feedings/day:

0-8 wks corr.:

Breast-fed: 8-12/d

Formula: 6-8/d

8 wks-4 mo corr.:

Breast-fed: 6-10/d

Formula: 5-7/d



Volume/day:

0-4 mo.: 18-32 oz/d

4-6 mo: 27-45 oz/d

6-12 mo: 24-32 oz/d

Introduction of Solids

- Timeline is same as for the full term
- Infant cereals should be started at 4-6 mo. **corrected age**, when developmentally ready (decreased tongue extrusion and mature head and trunk control).
- Water: not routinely in infants <4-6 mo., after that can be given as a supplement , not as a substitute to formula
- Oral aversion: refer to an OT

Dietary Supplementation for the Formula-fed Preterm

- Iron needs for the preterm are greater as compared to the full term infant
- The smaller at birth, the greater the iron needs → LBW: 2 mg/kg; ELBW: 4 mg/kg
- Formula provides ~ 1.8 mg/kg of iron/d, which is less than the recommended 2-4 mg/kg/d
- AAP: 1 mg/kg/d iron for formula-fed preterm infants started at 1 month (Fe-in-sol or Poly-vi-sol w/ Fe)



Dietary Supplementation for the Breastfed preterm infant

- **Iron in breastmilk:** greatly bioavailable, but insufficient for the preterm
- **AAP:** for the breastfed preterm or LBW infant, 2 mg/kg/d (elemental iron) oral iron drops should be given starting at 1 month of age, until 12 month corrected age



- **Vitamin D** needs are not met for the breastfed infant, unless they consume > 24 oz of formula
- **AAP:** preterm breastfed infants should receive 1 dose/d of multivitamin drops until 5 kg (11 lbs)



Initial Interview: Nutrition History

- GA and BW → determine corrected age, wt/age at birth, current anthros
- Was infant on TPN > 4wks?
- Medical Dx ?
- When was infant first fed, what, how, difficulties or intolerances?
- Medications?
- Supplements?
- Feeding regimen at discharge



Infants w/ Highest Nutrient Needs: **Your first priority**

- Birth Weight <1000g (2# 3oz) or
- Birth weight >1000g and discharge weight < 1850g (4 # 1 oz) or
- Growth < 5th%ile or
- Bronchopulmonary dysplasia
- Osteopenia



Assessment

Step 1: Growth: at least expected, catch-up is not unusual.

Step 2: Is formula adequate? *neosure/enfacare is rec. for infants born < 4 lbs 1 oz, to 9-12 mo, even if infant is at optimal growth parameters.

Step 3: Assess frequency and volume of feeds. How long do feeds last.

Step 4: Does infant need dietary supplements?

What if infant is poorly growing?

1. Contact MD to switch formula if applicable.
2. Review how formula is prepared (1 scoop/2oz).
3. Maximize frequency:
 - 0-8wks: 8X/d (formula), 12x/d(BM)
 - 8-4 mo. 7X/d(formula), 10x/d(BM)
4. Does baby finish bottles →
 - if so, increase volume
 - if not, does he tires easily, feeds last too long? (max should be 30 min.)
 - if so, contact MD and suggest increasing concentration to 24 kcal/oz and/or refer to OT.
5. Contact MD if infant has of chronic vomiting, diarrhea or other medical issues.

TAKE HOME: maximize volume first, fortify second.

How often do I follow? (some guidelines)

In one month:

- High risk infant, X3mo.
- Suboptimal growth
- Wt/age < 5th%ile
- Wt/age > 97%ile
- Change of formula
- Exclusively breastfed infant (first 3 visits)
- Suboptimal intakes
- Complex medical Hx, X2 mo.
- Feeding aversion

In two months:

- High risk infant, past the first 3 visits.
- Optimal growth
- Wt/age 5th%ile < > 97%ile
- Adequate of formula
- Exclusively breastfed infant (after 3rd visit)
- Optimal intakes
- Mild medical Dx
- Adequate transition to solids

What about breastfeeding?



To be discussed at the next
telecast presentation

Goals

Promote adequate nutrition for optimal growth and prevention or reversal of clinical complications associated with premature birth.



Case Study: Jose

- DOB: Sept 21th, 2005
- Born: 10 weeks early.
- BW: 2 Lbs 2 oz
- Current wt (11/30):
5 lbs 7 oz
- Current formula:
Similac Advance
- Feeds 6-7 times/d,
2 ½ oz-3 oz, on
demand



1. Corrected age:
2. Wt/age:
3. Questions to ask mom?
4. Concerns regarding current feeding regimen?
5. What can you say to mom today?
6. What do you need to discuss with the MD?
7. Evaluate this infant nutritional risks:
8. How often should you follow:

Answers to case study

1. 0 d (on 11/30) and 1 wk (on 12/07).
2. 3-5% ile wt/age on NCHS growth age.
3. During hospital stay, what was Jose's medical Hx? Was he on IV nutrition (TPN), how long? What was he fed, how, any feeding difficulties or intolerances? How is he doing with current feeding regimen? Is Jose on any medications or supplements? Is he finishing his bottles? Is he tiring easily?
4. Jose should be on Neosure or Enfacare d/t prematurity. Intake is 15-21 oz/d of 20 kcal/oz formula vs recommended 18-32 oz/d of 22 kcal/d. Feedings are insufficient to promote adequate growth.
5. Would discuss increasing feeding frequency to 8 times/d, would also try increasing formula to 3-3 1/2 oz/feed. Will d/w mom advantages of using Neosure/Enfacare and plan to contact MD to propose the change.
6. Would suggest switching Jose to Neosure/Enfacare formula. Would also mention the need for 1 mg/kg/d of iron via PVS or Fe-in-sol.
7. High Risk: ELBW, < 5th %ile.
8. Every month X 3 months and until Jose shows adequate intake and growth pattern.

References:

- American Academy of Pediatrics. Pediatric Nutrition Handbook, 5th ed.; 2004
- S. Groh-Wargo, M. Thompson & J. Hovasi Cox. Nutritional Care for High-Risk Newborns, 3rd ed., Chicago, Ill.:Percept Press, Inc. 2000