Nutritional Interventions to Improve Outcomes for the Preterm Infant

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Disclosure

I am a member of the Speaker’s Bureau for Mead Johnson Nutrition

Objectives

• To describe the common nutritionally related complications of the preterm infant
• Discuss the benefits of human milk for the preterm infant
• To describe the role of nutrition in the prevention of nutritionally related complications
• To explain what specific nutrients must be supplemented when using human milk for the preterm infant
• To compare and contrast human milk fortification methods
• To provide guidelines for the safe handling, storage, and delivery of human milk in the hospital setting

Amy Gates 2015
Trends in Prematurity

- Prematurity continues to be the leading cause of infant mortality and morbidity in many countries around the world.
- N=24,371 premature infants discharged from 124 NICUs, 1997-2000
  - Estimated gestational age (GA) at birth: 23 to 34 weeks
- EUGR at discharge
  - 28% for weight
  - 34% for length
  - 16% for head circumference
- For each parameter, EUGR increased with decreasing GA and BW


Growth Expectations

<table>
<thead>
<tr>
<th>Weight (g)</th>
<th>500-700g</th>
<th>700-900g</th>
<th>900-1200g</th>
<th>1200-1500g</th>
</tr>
</thead>
<tbody>
<tr>
<td>g/kg/d, fetal</td>
<td>21</td>
<td>20</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td>g/kg/d, protein intake</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>3.9</td>
</tr>
<tr>
<td>Kcal/kg/d, energy intake</td>
<td>105</td>
<td>118</td>
<td>119</td>
<td>127</td>
</tr>
</tbody>
</table>

Ziegler, 2011
Poor HC Growth Increases Odds for Poor Outcomes


- Cerebral palsy: 4.10 (1.34–13.59)
- Bayley MDI <: 2.33 (1.10–4.95)
- Neurodevelopmental Impairment: 3.64 (1.85–7.18)

HC = Head circumference
MDI = Mental Development Index


Weekly Protein Intake and Cumulative Deficit

- Protein, g/kg
- Weekly Intake
- Cumulative Deficit

- ≤ 30 weeks
- ≥ 31 weeks

Nutrient Recommendations

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Unit/Kg Enteral*</th>
<th>Unit/Kg ESPGHAN**</th>
<th>Human milk, units/dL***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid, mL</td>
<td>150</td>
<td>135-200</td>
<td>-</td>
</tr>
<tr>
<td>Energy, Kcal</td>
<td>120-130</td>
<td>110-135</td>
<td>64.8-86.6</td>
</tr>
<tr>
<td>Protein, g</td>
<td>3.5</td>
<td>3.5-4 (4.5 &lt; 1kg)</td>
<td>1.9-2.3</td>
</tr>
<tr>
<td>Fat, g</td>
<td>1-4</td>
<td>4.8-6.6</td>
<td>4.4-4.8</td>
</tr>
<tr>
<td>Calcium, mg</td>
<td>200-220</td>
<td>120-140</td>
<td>24.8-29.6</td>
</tr>
<tr>
<td>Phosphorus, mg</td>
<td>100-110</td>
<td>60-90</td>
<td>6.2-6.8</td>
</tr>
<tr>
<td>Vitamin D, IU/day</td>
<td>400</td>
<td>800-1000</td>
<td>Trace</td>
</tr>
</tbody>
</table>

*Schanler 2014; Uptodate.com 2014; **ESPGHAN 2010; ***Bauer and Gerss 2010

Enteral Protein and Energy Requirements of Preterm Infants

<table>
<thead>
<tr>
<th>Body weight, g</th>
<th>Protein, g/kg/d</th>
<th>Energy, kcal/kg</th>
<th>P/E, g/100 kcal</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-700</td>
<td>4.0</td>
<td>105</td>
<td>3.8</td>
</tr>
<tr>
<td>700-900</td>
<td>4.0</td>
<td>108</td>
<td>3.7</td>
</tr>
<tr>
<td>900-1200</td>
<td>4.0</td>
<td>119</td>
<td>3.4</td>
</tr>
<tr>
<td>1200-1500</td>
<td>3.9</td>
<td>127</td>
<td>3.1</td>
</tr>
<tr>
<td>1500-1800</td>
<td>3.6</td>
<td>128</td>
<td>2.8</td>
</tr>
<tr>
<td>1800-2200</td>
<td>3.4</td>
<td>131</td>
<td>2.6</td>
</tr>
</tbody>
</table>

P/E = Ratio of protein to energy, expressed as grams of protein per 100 kcal.


Monitoring

- Return to Birth Weight [RTW] by DOL 7-10
- After RTW a weight gain expectations based on gestational age and birth weight [g/kg/day]
- Intervene within 7 days of growth faltering
- Measure length/ [0.7-1 cm/week expected growth]
- Monitor head circumference
Survey of Current Practices

- 31% reported having TPN protocols
- 61% reported having enteral feeding guidelines/protocols
- 28% reported adhering to the enteral feeding protocols
- Mean parenteral protein intake 1.8 g/kg/day on TPN day one
- 68% reported adding H2 receptors antagonists to TPN
- Gastric residuals reported as a contraindication of enteral feedings by 93% of respondents
- Presence of umbilical catheters reported as a contraindication of enteral feedings by 31% of respondents

Adopting a Feeding Protocol

Associated with
- Improved nutritional outcomes
- Decreased time to reach full enteral feedings
- Fewer TPN days
- Reduction of severe EUGR
- Correlation with fewer cases of NEC and infections

Properties of Human Milk

- ...
Disease and Risk Reduction in Breastfed Infants and Children

- Reduced Risk of:
  - Otis Media
  - Atopic Dermatitis
  - Gastrointestinal Infections
  - Asthma
  - Obesity
  - Type I and Type II Diabetes
  - Childhood Leukemia

Maternal Disease Risk Reduction

- Reduced Risk of:
  - Type II Diabetes
  - Metabolic Syndrome
  - Ovarian Cancer
  - Breast Cancer
  - Coronary Artery Disease
  - Aortic Calcifications
  - Coronary Calcifications

Improved Fat Absorption

- Lipase improves fat digestion
- Triglycerides in human milk are broken down into free fatty acids and glycerol by bile salt dependent lipases found in the human milk
- The fat in human milk is reflective the dietary fatty acids of the mother’s diet
- A fatty acid supplement containing DHA/ARA will improve the profile in the mother
- Choose fortifiers that contain DHA/ARA
Protein

- Human milk contains 70% whey and 30% casein for ease of digestion
- Protein content varies between mothers, pumping times, and number days postpartum
- Protein content decreases overtime
- Preterm human milk initially contains more protein than term human milk
- Protein content inadequate to support the needs of the preterm infant

Protective Qualities of Human Milk

- Anti-infective factors - During the first 10 days there are more white cells per ml than there are in blood
- Macrophages and neutrophils are among the most common leucocytes in human milk and they surround and destroy harmful bacteria by their phagocytic activity
- Secretory IgA and interferon are important anti-infective agents produced in abundance by lymphocytes in human milk
- Oligosaccharides – protection and fosters Lactobacillus bifidus

Prebiotics

- Typically a mixture of Galacto and Fructo-oligosaccharides
- Support the growth of probiotic Lactobacilli and Bifidobacteria in the bowel
- Prebiotic substances are naturally present in breast milk and are resistant to gastric acid digestion
Lactoferrin

- Lactoferrin is an antimicrobial glycoprotein present in colostrum
- Key component of the mammalian innate response to infection
- Broad microbial activity against Gram-positive cocci, Gram-negative bacilli, and Candida species
- Lactoferrin has prebiotic properties creating an enteric environment for the growth of beneficial bacteria and reducing colonization harmful bacteria

Colostrum

- Produced in the first 36-48 hours after birth
- Has a laxative effect which helps with the passing of meconium
- Contains large quantities of secretory immunoglobulin A (IgA)
- Aids gut maturation (gut priming)
- “Paints” the gastrointestinal tract with a protective barrier
- Can begin immediately after colostrum is available
- Colostrum can be used as oral care (cotton tip swab/gloved finger) for infants who are NPO
- Some cultures perceive colostrum as “dirty” and may discard it. Education is essential.

Benefits of Human Milk for the Preterm Infant


Amy Gates 2015
MOM vs. Preterm Formula

- N=108, 28 weeks, 1000 grams
- FEBM fed had:
  - Decreased Infection (19 vs 22%)
  - Decreased NEC (p<0.01)
  - Earlier Discharge (73 vs. 88 days, p<0.03)

Schanier (1999)

Mother’s Milk, Donor Milk, and Preterm Formula

<table>
<thead>
<tr>
<th>Characteristic of Study Infant</th>
<th>Group HM</th>
<th>Group FF</th>
<th>Group MFM</th>
<th>Group HM vs. Group FF</th>
<th>Group HM vs. Group MFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth weight, g, mean ± SD</td>
<td>2741 ± 151</td>
<td>2672 ± 145</td>
<td>2744 ± 151</td>
<td>2741 vs. 2672, p&lt;0.05</td>
<td>2744 vs. 2672, p&lt;0.05</td>
</tr>
<tr>
<td>Gestational age, wk</td>
<td>27 ± 2</td>
<td>27.5 ± 2</td>
<td>27.5 ± 2</td>
<td>27 vs. 27.5, p=0.15</td>
<td>27.5 vs. 27.5, p=0.15</td>
</tr>
<tr>
<td>Birth weight at 34 weeks, g</td>
<td>740 ± 50</td>
<td>720 ± 50</td>
<td>750 ± 50</td>
<td>740 vs. 720, p&lt;0.05</td>
<td>750 vs. 720, p&lt;0.05</td>
</tr>
<tr>
<td>SI for feedings at 34 weeks</td>
<td>54 ± 10</td>
<td>52 ± 10</td>
<td>56 ± 10</td>
<td>54 vs. 52, p&lt;0.05</td>
<td>56 vs. 52, p&lt;0.05</td>
</tr>
<tr>
<td>Mortality rate, %</td>
<td>14 ± 4</td>
<td>10 ± 4</td>
<td>12 ± 4</td>
<td>14 vs. 10, p&lt;0.05</td>
<td>12 vs. 10, p&lt;0.05</td>
</tr>
<tr>
<td>Chorioamnionitis, %</td>
<td>13 ± 3</td>
<td>15 ± 3</td>
<td>12 ± 3</td>
<td>13 vs. 15, p=0.10</td>
<td>12 vs. 15, p=0.10</td>
</tr>
<tr>
<td>Temperature of central venous line, °C</td>
<td>37 ± 0.5</td>
<td>37 ± 0.5</td>
<td>37 ± 0.5</td>
<td>37 ± 0.5</td>
<td>37 ± 0.5</td>
</tr>
<tr>
<td>Age at first feeding of milk, mL</td>
<td>30 ± 10</td>
<td>30 ± 10</td>
<td>30 ± 10</td>
<td>30 ± 10</td>
<td>30 ± 10</td>
</tr>
</tbody>
</table>

Schanler et al., Pediatrics 2005

Mother’s Own Milk

- Schanler, 1999

- HM > 50 mL/kg
- HM + F
- PTF
Donor Human Milk

Donor Milk and NEC [%]

Scharler et al., 2005; Boyd et al. Arch Dis Child Fetal Neonatal Ed 2006

Bacteriological Screening of Donor Human Milk Before Holder Pasteurization

Scharler et al. 2005 Arch Dis Child Fetal Neonatal Ed 2006

Scharler et al., 2005; Boyd et al. Arch Dis Child Fetal Neonatal Ed 2006

Scharler et al. 2005 Arch Dis Child Fetal Neonatal Ed 2006
Microbial Contamination of Human Milk Purchased via the Internet

- 74% of internet milk samples were colonized with Gram-negative bacteria
- Internet samples had higher counts of staphylococcus than milk bank samples
- No HIV
- 21% CMV +
- Donor of the internet samples were unknown and screenings not performed
- Instructions for safe pumping and handling were not given

Keim, et al. PEDIATRICS Vol. 132 No. 5 November 1, 2013

Peer to Peer Donation

- Used when banked pasteurized donor milk unavailable
- Payment increases risks associated with peer to peer donation
- Purchasing milk from an unknown source [online] is not recommended
- Donor health and disease status should be known
- Provide instructions for safe pumping, handling, delivery


Fortification

Amy Gates 2015
Human Milk Feedings
Preterm Infants

Benefits
- Reduction in NEC
- Reduces intestinal permeability
- Stimulates cell proliferation
- Better gastric emptying
- Better feeding tolerance
- Fewer infections
- Enhanced maternal-infant bonding

Risks
- Decreased growth
- Metabolic bone disease
- Vitamin and mineral deficiencies
- Fortification is a must with both MOM and Donor Milk

Macronutrient Composition

<table>
<thead>
<tr>
<th></th>
<th>Protein, g/dL (mean)</th>
<th>Energy, kcal/dL (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
<td>0.8-1.5 [1.2]</td>
<td>57-83 [70]</td>
</tr>
<tr>
<td>Donor</td>
<td>0.6-1.4 [0.9]</td>
<td>50-115 [67]</td>
</tr>
<tr>
<td>Preterm &lt;29wk@</td>
<td>1.3-3.3 [2.2]</td>
<td>61-94 [78]</td>
</tr>
<tr>
<td>Preterm 32-33 wk@</td>
<td>1.3-2.5 [1.9]</td>
<td>64-89 [77]</td>
</tr>
<tr>
<td>Preterm, donor</td>
<td>0.8-1.9 [1.4]</td>
<td>53-87 [70]</td>
</tr>
</tbody>
</table>

Adapted from: Ballard and Morrow. Pediatric Clinics of N. America. 2013

Intake of Enteral Protein As Feedings are Advanced

<table>
<thead>
<tr>
<th>Grams of Protein</th>
<th>Preterm MOM</th>
<th>PDHM</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mL</td>
<td>0.14</td>
<td>0.09</td>
</tr>
<tr>
<td>20 mL</td>
<td>0.28</td>
<td>0.18</td>
</tr>
<tr>
<td>40 mL</td>
<td>0.56</td>
<td>0.36</td>
</tr>
<tr>
<td>60 mL</td>
<td>0.84</td>
<td>0.54</td>
</tr>
<tr>
<td>80 mL</td>
<td>1.12</td>
<td>0.72</td>
</tr>
<tr>
<td>100 mL</td>
<td>1.4</td>
<td>0.9</td>
</tr>
<tr>
<td>120 mL</td>
<td>1.68</td>
<td>1.08</td>
</tr>
</tbody>
</table>
Fortification Goals

- Preserve the quality of the human milk
- Limit volume displacement of human milk by fortifiers
- Provide adequate levels of limiting nutrients [protein, energy, calcium, phosphorus, Vitamin D]
- Protect breastfeeding and maternal milk supply
- Limit intolerances often associated with fortification
- Prevent contamination of human milk with harmful pathogens

Fortification Basics

- Use sterile fortifiers when available
- Establish human milk feeding
  - Trophic feedings first [10-20 mL/kg/day]
  - Advance slowly
- Lab values can help guide fortification adjustment [BUN]
- Fortify at 80-100 mL/kg/day
- Standardize fortification
- Standardize feeding advancement protocol
- Use only manufactured approved approved recipes/ratios
- Train staff on safe handling and preparation; limit bedside mixing
- Use caution when adding additional ingredients to an already concentrated fortifier [fat, protein, carbohydrate powders, formula powders]

Liquid Fortifiers Compared

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>LHMF 1 (Amount in parenthesis is what is provided with goal feeds of 150 mL/kg/day)</th>
<th>LHMF 2</th>
<th>LHMF 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kcal/oz</td>
<td>115-130 kcal/kg (24) 28 24</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Protein, g/100 calories</td>
<td>6.6 g/kg (8.4-8.8)</td>
<td>7.27</td>
<td>6.1 (6.3)</td>
</tr>
<tr>
<td>Calcium, mg/100 calories</td>
<td>120-200 mg/kg (143)</td>
<td>143</td>
<td>143</td>
</tr>
<tr>
<td>Vitamin D, IU/100 calories</td>
<td>115-130 (95-121)</td>
<td>121</td>
<td>121</td>
</tr>
<tr>
<td>Iron, mg/100 calories</td>
<td>4.4 mg/kg (4.5-4.7)</td>
<td>4.6 (4.8)</td>
<td>4.7 (4.8)</td>
</tr>
<tr>
<td>Phosphorus, mg/100 calories</td>
<td>60 (45)</td>
<td>65</td>
<td>65</td>
</tr>
<tr>
<td>Kcal/oz</td>
<td>115-130 kcal/kg (24) 28 24</td>
<td>24</td>
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<tr>
<td>Phosphorus, mg/100 calories</td>
<td>60 (45)</td>
<td>65</td>
<td>65</td>
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</tbody>
</table>

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Intake of Enteral Protein As Feedings are Advanced

Human Milk Fortified at 80 ml/kg/day

<table>
<thead>
<tr>
<th>Grams of Protein</th>
<th>LHMF 1</th>
<th>LHMF 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mL</td>
<td>0.14</td>
<td>0.14</td>
</tr>
<tr>
<td>20 mL</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
<td>40 mL</td>
<td>0.56</td>
<td>0.56</td>
</tr>
<tr>
<td>60 mL</td>
<td>0.84</td>
<td>0.84</td>
</tr>
<tr>
<td>80 mL</td>
<td>2.65</td>
<td>2.38</td>
</tr>
<tr>
<td>100 mL</td>
<td>3.32</td>
<td>2.97</td>
</tr>
<tr>
<td>120 mL</td>
<td>3.98</td>
<td>3.55</td>
</tr>
</tbody>
</table>

Mar 15

Single Nutrient Fortification

- Protein, Fat, or Carbohydrate Modifiers
  - Altering the protein:energy balance may enhance weight gain but not length or head circumference
  - Does not improved micronutrient profile [calcium, phosphorus, Vitamin D, iron]
  - Complete fortification is preferred
  - Balance carbohydrate, fat, and protein for a better protein:energy ratio

Growth Challenges

- Use a protocol for the weaning of TPN—balance intake of calories, fat, and protein between TPN and enteral
- Monitor BUN, total protein for adequacy of protein
- Maintain 4 g/kg/day of protein from DOL 1-2 and weight loss will be less thus resulting in less need for catch-up growth
- Use hind mind for infants receiving mother’s milk
- Watch the protein:energy ratio [addition of fat, protein, carbohydrate modular should be balanced]
- Growth from PDHM will be poor
  - Adjust to 26 calories/ounce with LHMF [no higher!]
  - Caution when weaning TPN
  - Progress to high protein formula once weight is 1500 grams if no mother's milk is available

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Supporting the Lactating Mother
Maintaining Milk Supply

Breastfeeding Barriers in the NICU

- Prolonged maternal-infant separation
- Mothers often pump dependent
- Immature infant may have difficulty latching
- Maternal illness
- Supplies are expensive—pumps, storage bottles

Initiation of Milk Volumes

- Onset of copious milk production normally occurs between 36-96 hours of life even in absence of a sucking infant
- Milk synthesis continues if milk is removed by the infant or by mechanical expression
- Milk stasis will occur and the milk supply will "dry up" if the milk is not removed
- Mothers of preterm infants are more likely to have a delay of lactogenesis and low milk volume than mothers who delivered at term
Delayed Lactogenesis

- Risk factors include
  - Diabetes mellitus
  - Preterm labor
  - Pregnancy induced hypertension
  - Excessive maternal blood loss
  - Prolonged bed rest
  - Maternal stress during labor and delivery
  - Unscheduled C-section
  - Obesity

Breast pumps

- Hand expression can help with retrieval of small quantities of colostrum
- Some women find hand expression to be more effective than pumping
- Hospital grade, double electric breast pump may be needed for NICU moms
- Experiment with different types of milk removal

Pumping Frequency

- Pump with a frequency that duplicates the frequency of feeding of a healthy term infant
- Simultaneously pumping both breasts reduces the time mothers spend pumping
- Instruct mothers to pump for 15 minutes initially
- After the onset of lactogenesis, pump two minutes after seeing the last droplets
- A well drained breast will produce more milk
Maintaining Milk Supply

- Encourage bedside pumping
- Skin-to-skin exposure [Kangaroo care] may help with milk volume
- Allow the infant to taste milk at mother’s breast during scheduled gavage feedings to help associate breast milk with feedings

Galactogogues

- Pharmacologic
  - Metoclopramide [Reglan]
  - Domperidone [Motilium]
- Herbs
  - Fenugreek
  - Brewers Yeast
  - Mother’s Milk Tea
  - Blessed Thistle

Storage, Handling, and Preparation of Human Milk in a Hospital Environment
Preparation of Human Milk in a NICU Setting

- Infections associated with contaminated or spoiled human milk and/or dirty breast pumps and equipment
- Standardize preparation/recipes
- Remove powdered formula products from the formulary
- Use plastic or glass bottles with sealable lids; no plastic bags
- Prepare milk separately from patient care areas
- Commercial or pharmacy grade refrigerators and freezers are needed to hold milk at the appropriate temperature
- Sterile fortifiers offer an added protection against possible contamination
- Milk preparation should not be done in diapering area
- Use aseptic technique
- ADA Infant Feedings: Guidelines for Preparation of Human Milk and Formula in Health Care Facilities, 2nd Edition

Refrigerators and Freezers

- Use commercial grade equipment
- Exterior alarms allow for reading of temperature without opening the door
- Must be able to maintain correct temperatures \([35\,\text{to}\,40\,\degree\,\text{F or} <2\,\degree\,\text{F} \text{for freezers}]\)

Temperature Controls and Expiration Times

<table>
<thead>
<tr>
<th>Storage Method</th>
<th>Storage Time [Expiration]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freezer [home unit combined with freezer]</td>
<td>3 months</td>
</tr>
<tr>
<td>Freezer [&lt;4 degrees F]</td>
<td>6-12 months</td>
</tr>
<tr>
<td>Refrigerator, Fresh milk [40 degrees F]</td>
<td>48-96 hours</td>
</tr>
<tr>
<td>Refrigerator, thawed milk [40 degrees F]</td>
<td>48 hours</td>
</tr>
<tr>
<td>Refrigerator, fortified milk [40 degrees F]</td>
<td>36 hours</td>
</tr>
<tr>
<td>Refrigerator, thawed pasteurized donor milk [40 degrees F]</td>
<td>48 hours</td>
</tr>
<tr>
<td>Cooler with gel packs, fresh milk [59 degrees F]</td>
<td>24 hours</td>
</tr>
<tr>
<td>Room temperature [77 degrees F]</td>
<td>&lt;4 hours</td>
</tr>
</tbody>
</table>

Amy Gates 2015
Educate Mothers

- Hand washing
- Wash pumping supplies and containers with hot soapy water and let air dry
- Milk should be refrigerated within 4 hours of pumping
- Transport in an insulated container with frozen gel packs [no ice]
- Label all containers with name, date, time

Contraindications and Precautions

Medications

- Most medications are compatible with breastfeeding
- Transfer of medications from human milk to the infant is typically low and not harmful
- Switch medications to safer alternatives when appropriate
- Refer to Medications and Mothers’ Milk 14th ed. 2010, Thomas Hale
- Lactmed Database
Contraindicated Medications

- Amiodarone
- Chemotherapy Agents
- Chloramphenicol
- Drugs of Abuse
- Ergotamine
- Gold salts
- Lithium
- Phenindione
- Radioactive compounds
- Retinoids
- Tetracyclines [chronic use >3 weeks]

Contraindications

- An infant diagnosed with galactosemia, a rare genetic metabolic disorder
- The infant whose mother:
  - Has been infected with the human immunodeficiency virus (HIV)
  - Is taking antiretroviral medications
  - Has untreated, active tuberculosis
  - Is infected with human T-cell lymphotropic virus type I or type II
  - Is using or is dependent upon an illicit drug
  - Is taking prescribed cancer chemotherapy agents, such as antimetabolites that interfere with DNA replication and cell division
  - Is undergoing radiation therapies; however, such nuclear medicine therapies require only a temporary interruption in breastfeeding

Not Contraindicated

Breastfeeding is NOT contraindicated with the following conditions:

- Infants born to mothers who are hepatitis B surface antigen-positive
- Mothers who are infected with hepatitis C virus (persons with hepatitis C virus antibody or hepatitis C virus RNA-positive blood)
- Mothers who are febrile (unless cause is a contraindication outlined in the previous section)
- Mothers who have been exposed to low-level environmental chemical agents
- Mothers who are seropositive carriers of cytomegalovirus (CMV) [not recent converters if the infant is term]
- Mothers who smoke tobacco (though they should be encouraged to quit) or have an occasional celebratory drink
- The great majority of babies with jaundice or hyperbilirubinemia can continue to be breastfed without interruption

Centers for Disease Control [CDC]
http://www.cdc.gov/breastfeeding/disease/index.htm


Amy Gates, 2015
Breast Milk Acquired Cytomegalovirus Infection in the VLBW and Premature Infant

- 19% of infants fed untreated breastmilk acquired CMV infection
- 4% developed CMV-SLS
- Effectiveness of freezing to inactivate CMV varies by storage temperature and length of time frozen
- Benefits of breastmilk feeding appears to outweigh the risk of severe disease associated with breastmilk acquired CMV infection
- Risk of transmission may be reduced with proper handling and storage

N= 200

Amy Gates 2015

Lanzieri, PEDIATRICS Volume 131, Number 6, June 2013

Using NICU Nutrition Practices

- The Old
  - Formula feedings
  - Bedside mixing
  - Pooled preterm formulas used as modular and fortifiers
  - Heavy use of modules and “special” recipes
  - Low protein; high carbohydrate diets
  - Slow advancement of TPN

- The New
  - Aggressive TPN management
  - Human milk as the standard feeding
  - New generation liquid human milk fortifier
  - Use bread milk, human milk cream to increase calories
  - Milk preparation rooms; milk techs
  - Targeted fortification; human milk analysis
  - Monitoring of specific values for targeted fortification (BUN, Vitamin D, iron)
  - Feeding protocols
  - Emphasis on balanced energy intake and protein adequacy

Conclusion

- Human milk contains naturally occurring components that may protect against NEC and infection
- Feeding protocols may reduce feeding related complications
- Human milk provides protective qualities not found in infant formula
- Donor milk can be used to compliment mother’s milk—but it is not nutritionally equal
- Human milk must be fortified for the preterm infant
- Guidelines must be followed to prevent contaminating or spoiling human milk

Amy Gates 2015