Breastfeeding: Immunological, Cognitive and Nutritional Advantages

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Susan L. Johnson, Ph.D.
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9:45 – 11:15

Disclosure

Madeleine Sigman-Grant, PhD, R.D.N.
- Board Member/Advisory Panel
  - AAP Bright Future, Early Nutrition Expert
- Consultant
  - State of Nevada, Dept. of Health & Human Services, Division of Public and Behavioral Health
- Retired from the University of Nevada Reno, Cooperative Extension
- Associate Editor, Journal of Nutrition Education and Behavior

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- Professor, University of Colorado Anschutz Medical Campus, Department of Pediatrics, Section of Nutrition
- Associate Director, Nutrition T32 Training Grant
- Associate Editor, Journal of Nutrition Education and Behavior
- Research Support
  - United States Department of Agriculture
  - National Institutes of Health
  - Health and Human Services
  - The Sugar Association
- Speaker Honoraria
  - Alliance for Potato Research and Education

Learning Outcomes

At the end of this session, participants will be able to...

1. Describe three areas of research related to the advantages of breastfeeding that goes beyond nutrition.
2. Apply evidence-based knowledge on breastfeeding, developmental readiness, and responsive feeding to inform their practice.
3. Identify three strategies that can be used in communicating evidence-based child feeding information to the public.

Session Contents

- Introduction
- Functions of The Mammary Gland & Human Milk
- Developmental readiness and Responsive feeding
- Practice Applications
- Conclusions and Unanswered Questions
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A Bit of History

- 20th century – nutrition
- Bigger is better
- If can’t measure, is it important?
- Medical interventions superior to nature

There are no new questions... but there are new ways to answer old questions.

Technological Advances

- EPGENETICS
- ULTRASOUND
- INFANT BRAIN IMAGING
- MICROBIOME

Pregnancy-Lactation Cycle

- Lactation starts at implantation
- Newborns need immediate protection from the environment
- Exogenous nutrition and growth factors continues the *in utero* environment

A and B. Ultrasound image of a main milk duct (Toshiba, Aplio). The nipple is the round hypoechoic (dark) structure in the left of the image (N). The main duct (M) branches into two ducts (B) approximately 5 mm from the nipple. Note the small diameter of the ducts (~3 mm).

Immune Response

Breastfeeding protects especially via secretory IgA antibodies.

**Mother’s gut**

- Blood
- Bacteria, viruses, foods, etc.
- Lymphocytes
- Peyer’s patch
- Mammary glands
- Salivary glands
- SIgA antibodies

Breastfeeding protects especially via secretory IgA antibodies.


**Immunological Components in Human Milk**

- Anti-microbial Compounds
- Immune Development
- Tolerance/priming compounds
- Anti-inflammatory Compounds

**Some of the Immunological Components**

- **Antistaphylococcal factor(s)**
- **Antiviral factor(s)**
- **Bifidus factor**
- **Catalase**
- **Chemotactic factors**
- **Complement**
- **Cytokines**
- **Erythropoietin**
- **Gangliosides**
- **Human Milk Oligosaccharides**
- **Immunoglobulins** (IgG, IgA, IgM, IgE, IgD)
- **Interferon**
- **Interleukins**
- **Leukocyte enzymes**
- **Leukocyte enzymes**
- **Lymphocytes**
- **Lysozyme**
- **Macrophages**
- **Neutrophils**
- **Postaglandins**
- **Proteases**
- **Sulfhydryl oxidase**
- **T-lymphocytes**

**Nutritional components**

<table>
<thead>
<tr>
<th>Human Milk</th>
<th>Formula</th>
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</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>Carbohydrates</td>
</tr>
<tr>
<td>Fiber (Human Milk Oligosaccharides)</td>
<td>NONE</td>
</tr>
<tr>
<td>Protein (kappa casein)</td>
<td>Protein (beta casein)</td>
</tr>
<tr>
<td>Fats</td>
<td>Fats</td>
</tr>
<tr>
<td>Non-protein nitrogen</td>
<td>Non-protein nitrogen</td>
</tr>
<tr>
<td>Vitamins</td>
<td>Vitamins</td>
</tr>
<tr>
<td>Minerals</td>
<td>Minerals</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>NONE</td>
</tr>
<tr>
<td>Energy - ??</td>
<td>Energy = 20 kcal/oz</td>
</tr>
</tbody>
</table>

**Cognitive Advantages - Measurement Difficulties**

- Maternal vs. professional
- Definition of breastfeeding
- Maternal Recall of BF exclusivity and duration
- Skills Measurements: gross & fine motor; communication; personal-social; problem-solving
  - Bayley Scales of Infant Development
  - McCarthy Scales of Children's Abilities
- Adjustment for confounding variables: SES; maternal health; maternal IQ

Breastfeeding: Immunological, Cognitive and Nutritional Advantages

### Epidemiological Studies – overall cognition

<table>
<thead>
<tr>
<th>First Author</th>
<th>Journal/Year</th>
<th>Findings</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belfort</td>
<td>JAMA Pediatr 2013</td>
<td>+ US/ w/ maternal fish intake; @ 2&amp;7 y; adjusted Maternal IQ+SES; UK/ w/ duration (2m-2.4m=4m); @5y; adjusted SES;</td>
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<tr>
<td>Heikkila</td>
<td>Mat Child Nutr 2014</td>
<td>+ US/ w/ maternal fish intake; @ 2&amp;7 y; adjusted Maternal IQ+SES; UK/ w/ duration (2m-2.4m=4m); @5y; adjusted SES;</td>
<td></td>
</tr>
<tr>
<td>Jenkins</td>
<td>JPHP; 2014</td>
<td>- US/ w/ BF exclusivity &amp; duration; @3&amp;4 y; adjusted SES</td>
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<tr>
<td>Juarez</td>
<td>Dev Med &amp; Child Neu 2014</td>
<td>+ Spain; w/ &gt; 6 m duration; @4 y; adjusted SES; * w/ α-3 fa</td>
<td></td>
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<tr>
<td>Leventakou</td>
<td>J Epi Comm Health 2015</td>
<td>- gross motor Coza; w/ &gt; 6 m duration; @18m; adjusted SES</td>
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<tr>
<td>McCrocy</td>
<td>Mat Child Health 2013</td>
<td>+ Communication Ireland/ w/ any BF (no dose response); @9 m; adjusted SES</td>
<td></td>
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<tr>
<td>Sajad</td>
<td>J Epi Comm Health 2015</td>
<td>- Netherlands/ w/ duration (initially t); @6y; adjusted Maternal IQ+SES</td>
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</tbody>
</table>

### Mechanistic Studies – overall cognition

<table>
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<th>First Author</th>
<th>Journal/Year</th>
<th>Findings</th>
<th>Details</th>
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</thead>
<tbody>
<tr>
<td>Bernard</td>
<td>Pediatr Res 2015</td>
<td>- France/ colostrum fatty acid levels; @ 2 &amp; 3y; maternal fish intake; no assoc. with LCPPUFA</td>
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<tr>
<td>Deoni</td>
<td>Neuroimage 2013</td>
<td>NA US; duration; @ 10m-4y; quiet MRI; white matter microstructure; adjusted SES</td>
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<tr>
<td>Herba</td>
<td>Mat Child Nutr 2015</td>
<td>NA Netherlands/ @7w; cranial ultrasound; ↑ gangliothalamic ovoid diameter (↑ DHA) &amp; head circumference; adjusted Maternal IQ+SES</td>
<td></td>
</tr>
<tr>
<td>Morales</td>
<td>PLOS One 2011</td>
<td>+ Spain; @ 14m &amp; 4y; Genetic variation in J-FA desaturase &amp; ↑ FA elongase; adjusted SES</td>
<td></td>
</tr>
<tr>
<td>Twigger</td>
<td>J Hum Lact 2013</td>
<td>NA Stem cells differentiate into neural-like cells</td>
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### Differences between the anatomy of the newborn and that of the older child and adult

- Oral cavity and lower jaw (mandible) is smaller
- Lower jaw has slightly retracted sucking pads, contributes to limited space and provides a degree of stability for early sucking efforts
- The tongue fills the oral space and restricts its movement
- Airway protection more anatomically assured due to higher position of the larynx and the close approximation of the epiglottis and soft palate

### Developmental readiness in relationship to eating and feeding?

Developmental readiness related to eating and feeding focuses broadly on expanding a child’s overall capacity to be effective and developing a more well-rounded eating experience.
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What do you look for in terms of developmental readiness for introduction of complementary foods?
- Mouthing of objects and bringing the hand to the mouth
- The ability to take food into the mouth instead of expelling it (the disappearance of the extrusor reflex)
- Interest in self-feeding (finger foods and holding the spoon)

What are some critical points where developmental readiness is challenged?
- Breastfed infant: exclusive breastfeeding 5 – 6 months;
- Transition to pureed table foods
- Promoting of self-feeding or participating in feeding
- Drinking from a cup (vs. a sippy cup)

Responsive parenting
- Caregiver behaviors are responsive if:
  - they follow a child’s behavior within a few seconds (prompt),
  - are emotionally supportive of the child’s needs,
  - show a change from prior behavior indicating that they are dependent on the child’s signal (contingent),
  - and are related conceptually to the child’s prior action (developmentally appropriate).

Responsive feeding consists of:
1) ensuring that the feeding context is pleasant
   - the child is seated comfortably, ideally facing others;
   - expectations are communicated clearly;
   - the food is healthy, tasty, developmentally appropriate, and offered on a predictable schedule so the child is likely to be hungry;
2) attending to the child’s signals of hunger and satiety;
3) responding to the child in a prompt, emotionally supportive, contingent, and developmentally appropriate manner.

Responsive feeding teaches children:
- Caregiver will respond and meet his/her needs
- To begin to self-feed
- To experience new tastes and textures
- That eating and mealtimes are fun
- To try new foods
- To do things for his/herself
- To ask for help
- To trust that caregivers will respond to requests
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Practice Applications
• Working with Health Care Professionals
• Working with Families
• Working with Community Partners

Practice Applications
• Align your strategies with those with whom you are working
• Resonate with audience and what motivates their choices
• Brief motivational interviewing
  ▪ What’s your best effort? (removes guilt)
  ▪ Culture of audience
• MAKE YOUR ‘ADVICE’ ABOUT …

Stay Up-to-Date

Learn from yesterday, live for today, hope for tomorrow. The important thing is not to stop questioning.
Albert Einstein
Reference List


