Breastfeeding: *Evidence-base and physiological insights.*

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Community Birth Services Breastfeeding Seminar, 11 Sep 2013
1. Introduction
   *(why am I giving this talk?)*

2. Evidence-based decision-making
   *(research design, ethical considerations etc. – short activity)*

3. Overview: Benefits of breastfeeding
   *(claims, trends, history)*

4. Physiological insights
   *(contact, feeding, development, short quiz)*

5. Summary
   *(have you learnt anything?)*
Introduction
Introduction
2. Evidence-based decision-making
How do you know that breastfeeding is “right”?
Validity of Research (Design)

1. Cross-sectional observation
2. Randomized-control trial
3. Cross-over study
   ...
4. **Ethical Considerations?**
   - Risks vs. benefit
   - Informed consent
   - Confidentiality
Small-Group Activity

- 6 groups, 5-10 mins
- Each group:
  - Read study abstract
  - Identify main results (‘take-home message’)
  - Elect spokesperson to relay these
### Pre-Term Formula vs. Milk

<table>
<thead>
<tr>
<th></th>
<th>Three centre study</th>
<th>Two centre study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Centres</td>
<td>Cambridge, Ipswich, King’s Lynn</td>
<td>Norwich, Sheffield</td>
</tr>
<tr>
<td>No randomised</td>
<td>502</td>
<td>424</td>
</tr>
<tr>
<td>Neonatal diets assigned randomly</td>
<td><strong>Trial A:</strong> Diets used as sole enteral feed (mother chose not to provide her EBM)</td>
<td><strong>TF</strong>&lt;sup&gt;1&lt;/sup&gt; v PTF (EBM)</td>
</tr>
<tr>
<td></td>
<td><strong>Trial B:</strong> Diets used as supplements to mother’s EBM</td>
<td><strong>TF</strong>&lt;sup&gt;1&lt;/sup&gt; v PTF (EBM)</td>
</tr>
<tr>
<td>Follow up periods</td>
<td>9 Months post-term</td>
<td>18 Months post-term</td>
</tr>
<tr>
<td></td>
<td>Pilot follow up completed</td>
<td>Follow up completed</td>
</tr>
<tr>
<td></td>
<td>Developmental outcome data reported (3)</td>
<td>Developmental outcome data reported&lt;sup&gt;1&lt;/sup&gt;. Data from trial A included also in this paper for comparison</td>
</tr>
<tr>
<td></td>
<td>Follow up complete by 1993 (unpublished)</td>
<td>Follow up complete by 1993 (unpublished)</td>
</tr>
</tbody>
</table>

Randomised trial developmental outcome data for 7.5–8 years unreported, but epidemiological (non-randomised) developmental data on the first 300 children seen at 7.5–8 years were analysed according to whether mother provided her own expressed breast milk (EBM) or not and reported previously.<sup>13</sup>

BBM = banked (donated) breast milk; PTF = preterm formula; TF = standard term formula.
PROBIT

<table>
<thead>
<tr>
<th>Age</th>
<th>Total n</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>17 046</td>
<td>100</td>
</tr>
<tr>
<td>1 m</td>
<td>16 760</td>
<td>98.3</td>
</tr>
<tr>
<td>2 m</td>
<td>16 523</td>
<td>96.9</td>
</tr>
<tr>
<td>3 m</td>
<td>16 685</td>
<td>97.9</td>
</tr>
<tr>
<td>6 m</td>
<td>16 481</td>
<td>96.7</td>
</tr>
<tr>
<td>9 m</td>
<td>16 176</td>
<td>94.9</td>
</tr>
<tr>
<td>12 m</td>
<td>16 492</td>
<td>97.0*</td>
</tr>
</tbody>
</table>

**PROBIT I**
- 17 046 randomized mother-infant pairs recruited during postpartum hospital stay
- 8865 Mother-infant pairs enrolled to intervention
- 8181 Mother-infant pairs enrolled to control
- Mother-infant pairs attended:
  - 8679
  - 8535
  - 8653
  - 8562
  - 8403
- Mother-infant pairs attended:
  - 8081
  - 7968
  - 8027
  - 7919
  - 7773

**PROBIT II**
- 13 889 attended
- 276 did not attend
- 20 died

**PROBIT III**
- 13 879 attended
- 1200 did not attend
- 214 refused
- 6 died

**Assay Data**
- 7226 with assay data
- 6319 with assay data
Talk Overview

3. Overview: Benefits of breastfeeding
In 2006, 9.5 million deaths <5y
- 67% occurred in <1y
- 35% due to poor nutrition
- >10% due to sub-optimal (non-exclusive) breastfeeding
Consequences of Malnutrition
(first 2 years of life)

1. Stunted height
2. Impaired IQ
3. Reduced physical work capacity
4. Malnourished females:
   - Affected reproductive capacity
   - More complicated delivery
   - Their infants have LBW
5. When malnourishment is widespread, national development is affected
Breastfeeding vs. Not

1. Infants 20 times more likely to die  Bahl et al. 2005
   - Diarrhoea

2. Increased risk of immunological disease-basis
   - Asthma/atopy condition  Oddy et al. 2004
   - Juvenile diabetes  Sadauskaite-Kuehne et al. 2004

3. More likely to be overweight  Harder et al. 2005
   - Decreased cardiovascular health

4. Reduced IQ  Andersen et al. 1999

5. Mother has increased risk of:
   - Postpartum hemorrhage  Chua et al. 1994
   - Breast/ovarian cancer  Robenblatt et al. 1993
The Trend of Feeding


The History of Feeding

1. Breastfeeding has been a common feature of all cultures at all times

2. Late 1800s, science (biochemistry) changed perceptions in industrializing Europe/N. America

3. Challenges were changes in:
   - Lifestyle
   - Cultural values
   - Roles of mothers

4. Feeding became ‘growth-focussed’, therefore more/earlier $$\$$_
Research into Feeding
Humans vs. Commercially Exploited Animals!

Research Studies Published

Decade

pre-1970  1970s  1980s  1990s

Human
Animal
4. Physiological insights
Early Contact

First hour of life of great importance, helps with:

- Initiating feeding
- Strengthening bonding
- Colonizes baby with mother’s micro-organisms
The ‘love hormone’

Oxytocin:
1. Let-down reflex
2. Uterine contraction (placenta)
3. Social behaviour
   - Reduces inflammation
   - Reduces anxiety, fear (stress)
   - Increased calmness, trust
Physiological Basis of Feeding

*Post-partum*

- Helps milk flow
- Reduces bleeding post-partum
- Increases affection towards infant
- Emotional bonding increased

**Oxytocin**

- Makes uterus contract

**Works before or during a feed to make the milk flow**
Physiological Basis of Feeding
*Post-partum*

- Helps milk flow
- Helps with relaxation and sleep
- ‘Contraceptive’

**Prolactin**

- Sensory impulses from nipples
- Baby suckling
- Prolactin in blood
- Secreted after feed to produce next feed
- More prolactin secreted at night
- Suppresses ovulation
1. Formula is made from industrially-modified cow milk or soy products
2. During manufacture, nutrients are adjusted to be more comparable to breastmilk
3. However:
   - Quality of fat/protein cannot be altered
   - Absence of anti-infective and bio-active remain
   - Non-sterile
   - Unsafe in many other ways
   - Soy contains phyto-oestrogens (male fertility, female puberty)
Compared to substitutes (cow’s milk, formula) breastmilk has:

1. Lower amounts of protein? True
2. Higher whey : casein ratio? True
3. Has lower levels of taurine? False
4. Lower in PUFAs (poly-unsaturated fatty acids)? False
5. No enzyme to help break down fat (lipase)? False
6. Contains less *L. bifidus*? False
7. Lower concentrations of minerals? True
8. Immunoglobulins and sugars that prevent bacteria from attaching? True
1. Contains all the nutrients that an infant needs for 6 months
2. Easily digested, efficiently used
3. Components discussed:
   - Fats
   - Carbohydrates
   - Proteins
   - Vitamins and Minerals
   - Other (Immune, Growth Factors)
1. 3.5g / 100 ml (>50% energy)
2. Contains long-chain PUFAs (DHA, ARA) not available in other milks
3. DHA aids in neurological development (myelinization)
4. ARA aids functions of digestion and host defence (prostaglandins)
5. Lingual/gastric lipases aid in digestion of fat, especially when bile salts are immature (pre-term)
Carbohydrates

1. 7g / 100 ml (40% energy)
2. Lactose major CHO, although other oligosaccharides present, higher concentrations than other milks
3. Metabolised into:
   - Glucose (used for energy)
   - Galactose (develops nervous system, Ca/Fe absorption, *L. bifidus*)
4. Bifidus factor, not found in bovine milk
   - Helps acid environment, retarding pathogens
   - Bovine-based has higher pH, sugars fully digested (coliform, putrefactive)
Proteins

1. 0.9g / 100 ml (little energy)
2. Lower nitrogen (waste) spares immature kidneys
3. Whey : casein = 80 : 20
   - Softer gastric curd
   - Lactose synthesis
4. Higher in free amino acids
   - Taurine (bile salts)
5. Anti-pathogenic factors:
   - Immunoglobulins
   - Lysozyme/lactoferrin
1. Fat-soluble vitamins:
   - A, D, E, K
2. Water-soluble vitamins:
   - B, C
3. Minerals:
   - Ca, Fe, P, Mg, Zn, K, F-
   - Concentrations lower, bioavailability higher
4. As above for trace elements
1. Immune Factors:
   - Macrophages, protect against infection
   - Stem cells, repair
   - Cytokines, immune response

2. Growth Factors:
   - Epidermal (intestinal mucosa)
   - Insulin-Like (erythrocyte)
   - Neutrotrophic (neurons)
   - Vascular Endothelial (blood vessels)
   - EPO
5. Summary
Summary...

1. Relatively few “robust” studies on benefits of breastfeeding exist
   – The most comprehensive (PROBIT) is still on-going!
   – However, many previous beneficial claims are being supported e.g. reduced infection, improved IQ

2. Rates of exclusive breastfeeding need to be increased, affected by substitutes
3. The importance of breastfeeding is apparent immediately post-partum
   - Mother’s health
   - Bonding
   - Healthy micro-organisms

4. All substitutes have disadvantages and are sub-optimal

5. Breastmilk is a complete food that contains everything needed for infant development
   - Macro-/micro-nutrients
   - Bioactive compounds
Questions?

