1

I have no relevant financial relationship(s) with ineligible companies to disclose for this presentation.

2

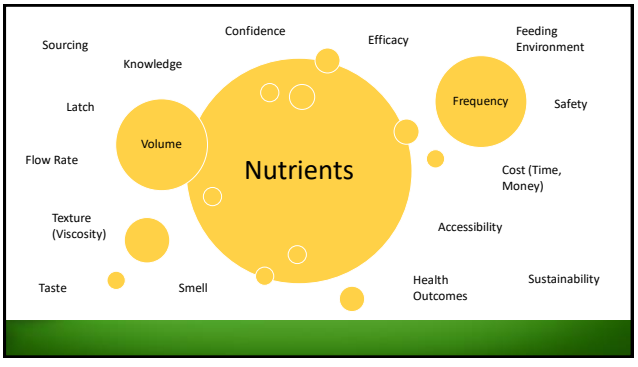
Polling Time!!!

3

Objectives

- Identify the nutritional components in human milk.
- Compare to the nutritional components in artificial formulas.
- Analyze case studies to bolster confidence in human milk.

4



5

Energy Yielding Components

- **Protein**
- **Fat**

Lactose (sugar) + Oligos (fiber) =

- **Carbohydrate**

6

Polling Time – Protein



7

Protein Amount


Lowest Protein of all Mammals
Slowest Body Growth


Higher Protein (3x protein)
Double Weight (4x Faster)


Highest Protein (15x more)
Infrequent Nursing (1-2x per day)
Double Weight (20x Faster)

Dasgupta, 2015
Skibiel, 2013

8

Protein ~1 g/dL

- **4 Calories/gram**
- **5-10% of energy content**
- **Building block for lean tissue**
- **Protein digesting and protecting enzymes**

Luskin, 2022
Fenton and Elmrayed, 2021
Kim and Froh, 2012

9

Protein Source

Human
- Others from food, contact, or air?

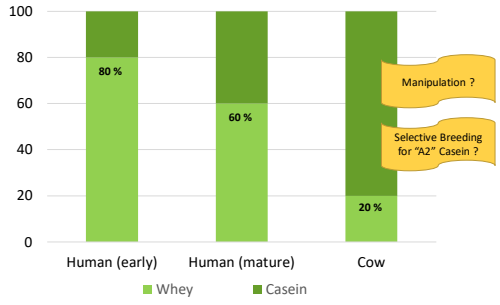
≠

Other Animal Species
- Cow
- Goat

Plant
- Soy
- Toddler: Pea, Almond, Buckwheat

10

Protein Ratios



11

Protein Hydrolysis

Intact

Partially Broken Down

Extensively Broken Down

Amino Acid (Elemental)

X

Hypoallergenic (Europe)

Hypoallergenic (US)

**Hydrolysis using heat vs pork enzyme (not Halal or Kosher OU-D)

**Impacts taste and osmolality

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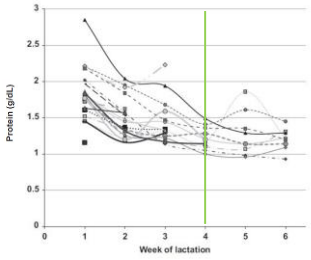
Protein Variability in Preterm Milk



Arnold et al, 2017

13

Polling Time – Fat




14

Fat Amount

Lowest Fat (15x less)
Long Nursing Duration (2 Years)
Dry Environment

Moderate Fat
Moderate Duration Nursing (~4 years)
Keep Young Close for Warmth

Highest Fat (15x more)
Shortest Nursing Duration (4 days)
Hostile Environment

Dasgupta, 2015
Skibiel, 2013

15

Fat ~3-4 g/dL

- **9 Calories/gram**
- **50% of energy content**
- **Building block for nervous system**
  - Unique triglyceride form
  - Fat globule size increases
  - Cholesterol
- **Lipase enzyme**

Fenton and Elmrayed, 2021
Kim and Froh, 2012

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Fat Source

Human ≠

Plant
- Soybean Oil
- Safflower Oil
- Sunflower Oil
- Coconut Oil (source of MCT Oil)
- Palm Olein Oil
- Also: Canola Oil

Other Animal Species
- Cow

**Liquid formulas include an added emulsifier

17

MCT Oil

Human Milk

Standard Formulas

Enhanced Formulas

Specialty Formulas and Supplements

**Requires least digestion, used for fat malabsorption
**Does not contain essential fatty acids

18

DHA (Omega-3) and ARA (Omega 6)

Human Milk
- Natural production
- Enhanced by intake of low mercury oily fish, walnut, flax/chia seeds

Formulas
- Algae (C Cohnii) oils
- Fungal (M Alpina) oils
- Fish oil (Europe)

Embleton & Berrington, 2022

19

Foremilk/Hindmilk: Yes

	Foremilk	Hindmilk	Average
√	**~1 g/dL** 13 kcal/oz	**~9 g/dL** 33 kcal/oz	~23 kcal/oz

Prior Full Expression

20

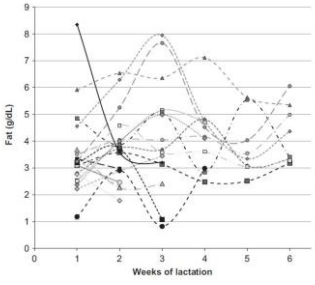
Foremilk/Hindmilk: No

	Foremilk	Hindmilk	Average
X	**~7 g/dL** 30 kcal/oz	**~6 g/dL** 27 kcal/oz	~28 kcal/oz
X	**~10 g/dL** 34 kcal/oz	**~6 g/dL** 23 kcal/oz	~29 kcal/oz

Prior Incomplete Expression

21

Fat Variability (~1-8 g/dL) in Human Milk



Arnold et al, 2017

22

Bonus Slide: Using Early Milk

- **Colostrum** in order, even if frozen
  - Considered first 3-4 days
- Then ~50% **oldest frozen milk +** ~50% **fresh**
  - "FIFO" highest protein, early bioactive factors

Especially for preterm infants, suggest using up first 3-4 weeks frozen milk (at 50%) before switching to all fresh.

If possible, consider using first 4-6 weeks frozen milk (at 50%) if/when not directly nursing.

Meier et al, 2010

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Polling Time – Carbohydrates

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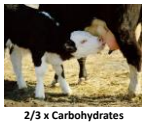
Carbohydrate Amount



2/3 x Carbohydrates
Smaller Brains
More Immunity Passed In Utero

Moderate Carb
Complex Brains
High Need for Immune Protection

Highest Protection (10x oligos)
Pouch Living (germs)

Dasgupta, 2015
Skibiel, 2013

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Carbohydrates ~7-8 g/dL

- **45% of Energy Content**
- **Lactose (energy) 4 Calories/gram**
  - Important energy source, ~5-6.5 g/dL
- **Oligosaccharide (protective fibers) 2 Calories/gram**
  - Important for gut biome, ~1.5-2 g/dL (or ~150-200 mg/dL)
- **Amylase enzyme**

Fenton and Elmrayed, 2021
Kim and Froh, 2012

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Energy Source

Lactose (glucose + galactose)
- Human or Cow Milk

≠

Sucrose (glucose + fructose)
Corn Syrup or Maltodextrin
Tapioca Starch
Potato Starch

Lactose (glucose + galactose)
- Goat Milk (Europe)

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Protective Fiber Source

HMOs (human milk oligosaccharide)
- >200 unique types
- 150-200 mg/dL

≠

GOS (galacto-oligosaccharide)
FOS (fructo-oligosaccharide)
PDX (polydextrose)
Cow Milk HMOs
- 0-5 unique types
- 25 mg/dL

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Energy Yielding Components

- ~1 g/dL Protein
- ~4 g/dL Fat

Lactose (sugar) + Oligos (fiber) =

- ~8 g/dL Carbohydrate

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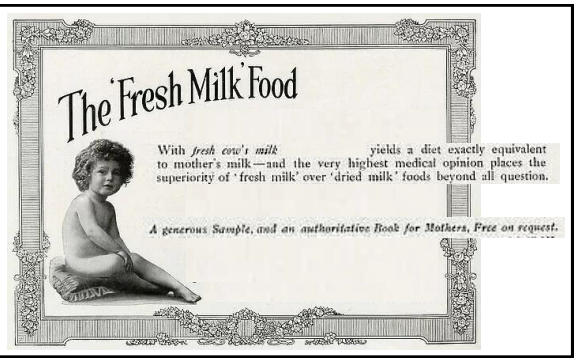

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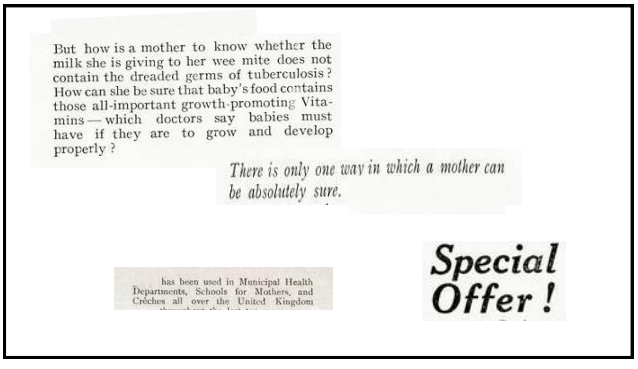

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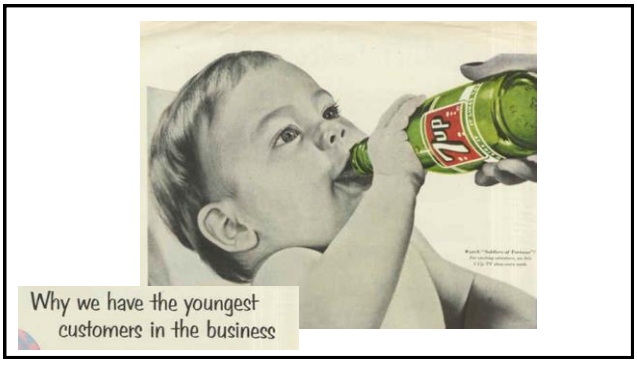

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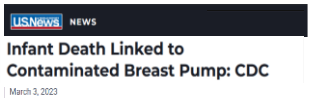
UN News
Search the United Nations
Baby formula marketing 'pervasive, misleading and aggressive' – UN report


USNews NEWS
Infant Death Linked to Contaminated Breast Pump: CDC
March 3, 2023

- Parent's need support – early and often
- There are more supplementing options than marketing suggests

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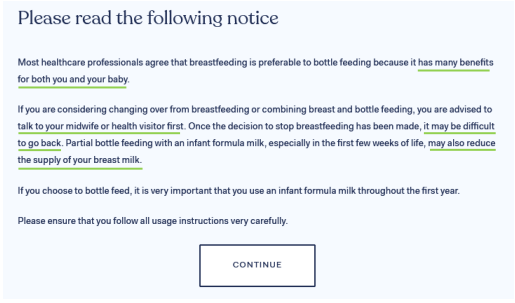
Please read the following notice

Most healthcare professionals agree that breastfeeding is preferable to bottle feeding because it has many benefits for both you and your baby.

If you are considering changing over from breastfeeding or combining breast and bottle feeding, you are advised to talk to your midwife or health visitor first. Once the decision to stop breastfeeding has been made, it may be difficult to go back. Partial bottle feeding with an infant formula milk, especially in the first few weeks of life, may also reduce the supply of your breast milk.

If you choose to bottle feed, it is very important that you use an infant formula milk throughout the first year.

Please ensure that you follow all usage instructions very carefully.

CONTINUE

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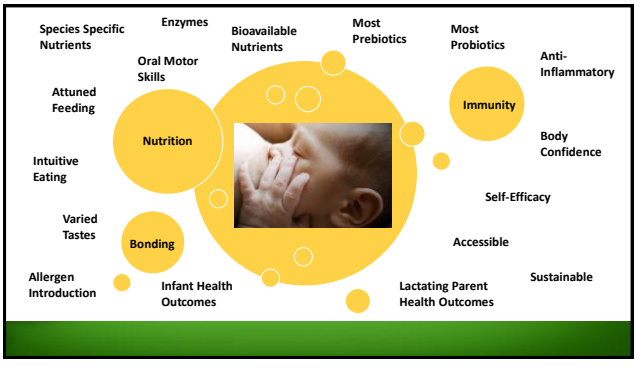

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Conclusions

- Human milk contains species-specific types and amounts of nutrients.
- Artificial formulas are still being formulated.
- Must look at bigger picture to support direct breast/chest feeding.

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Questions?

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