Infant Feeding Guidelines:
Updating the Evidence 2021

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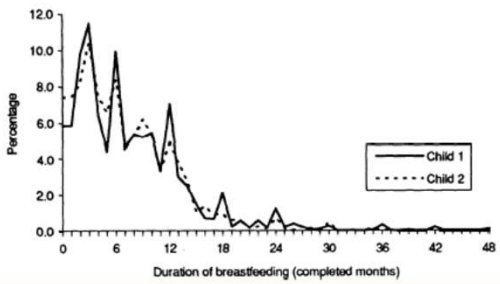
UPDATE 2012 Guidelines

Breastfeeding Research: Why its so hard
Other World Guidelines
Recent studies
Infections COVID19, HTLV1
Future directions:
Climate Change (Ann Rev PH)The UN Sustainable Development Goals

Breastfeeding Research: Why its so hard

The Ethics of Infant Feeding Studies
Not ethical to randomise: We rely on Cohort, Case-Control and animal studies.
Infant feeding is caring, nurturing, cultural

There has never been a RCT of Exclusive Breastfeeding
The PROBIT Study was not a RCT-
Infants already BF (no record of prelacteal feeds) were randomized at 30 days into extra education (cluster randomized) or not (Only mothers who were still EBF by WHO defn at that time were randomised.)
Showed a decrease in diarrhoeal disease and increased IQ.



Australia: Retrospective survey of mothers with children under the age of 5 years.

(Jain. ABS 1996)

The problem with recalls

Infant feeding has unique aspects

Infants rely on one food for six months

Therefore its important to promote breastfeeding and not a milk designed for a baby cow or goat.

Humans are the only species that requires complementary foods (foods given at 6 months as breastmilk is no longer enough)

Definitions

Exclusive Breastfeeding "the infant has received only breast milk from his/her mother or a wet nurse, or expressed breast milk, and no other liquids or solids with the exception of drops or syrups consisting of vitamins, mineral supplements or medicines"

Predominant (Full) Breastfeeding "infants who are receiving almost all of their nutrients from breastmilk but take some other liquids such as water, water-based drinks, oral rehydration solutions, ritual fluids, and drops or syrups."

Any Breastfeeding. The infant is receiving some breastmilk.

Major Reports we used

- **WHO short term and long term benefits** of breastfeeding (2 reports) Horta, Victora. 2013
- **Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries** (Ip et al) Evidence Report/Technology Assessment (USA). 2007
- **Surgeon General's Call to Action to Support Breastfeeding**. Washington, DC: Department of Health and Human Services Office of the Surgeon General. 2011.
- National Health & Medical Research Council, Australia. 2011

www.eatforhealth.gov.au

Infant Feeding Guidelines Literature Review

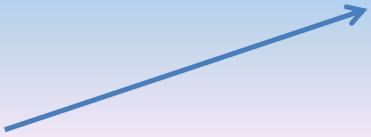
7000 references searched
2700 full text papers
Final volume is almost 600 pages with 800+ references

U

Almost all nutrition is "U-shaped", except

Too Little **Just Right** **Too Much**

Nutrition is a U-Shape world (except for breastfeeding)



Reports since the Infant Feeding Guidelines

1. Lancet Breastfeeding Series 2016 (free)

2. Breda, J., L. S. N. Castro, S. Whiting, J. Williams, J. Jewell, K. Engesveen and K. Wickramasinghe (2020). **"Towards better nutrition in Europe: Evaluating progress and defining future directions."** Food Policy **96**.

3. Dewey 2020 National Academy of Science Review (Free)

4. Numerous papers and reviews since 2013 (2225 in my file)

The Dewey Review

The committee identified 156 potentially relevant documents, webpages, and resources through its various search strategies. After applying the eligibility criteria, 43 guideline documents remained to be reviewed in more detail. Included guideline documents reflected the contributions of 26 different agencies, organizations, or groups from Australia, Canada, Europe, Italy, New Zealand, the United Kingdom, and the United States, along with global guidance from the World Health Organization. Nine of the guideline documents were collaborative efforts between two or more organizations.

Dewey Harrison. 2020 Feeding Infants and Children from Birth to 24 Months: Summarizing Existing Guidance National Academy of Science USA.

Exclusive breastfeeding.	**Up to, about, or around 6 months of age ***
Continuation of breastfeeding	Continuing breastfeeding for at least 12 months*(Not consistent in terms of the specific age)
Supplementary formula feedings	Should not be routinely given*
Duration of formula use	Until 12 months of age (not needed beyond 12/12)
Type of infant formula	Consistent in recommending cow milk–based infant formulas (soy-based formula be limited to special circumstances)*
Toddler and follow-on formulas	Recommending against the general use of toddler milks*
Cow milk	Not before 9 months of age (Range 9-12 months)(not consistent added to Complementary Foods before 12/12)
Whole milk	For children in the age range of 12–24 months (Limit amount)
Flavoured milk	Don't give to infants and young children
Fluids: Water, juice, sugar-sweetened beverages, other drinks	No water 0-6 months*, Water >6/12. No juice <12/12, No SSB, coffee, tea

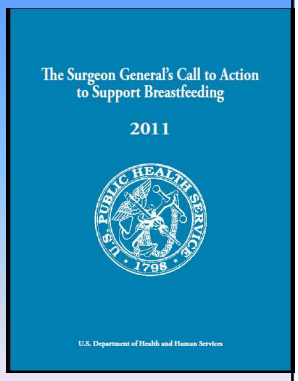
* Accepted in a large majority of the guidelines

Variety and healthy, nutritious foods	Variety of foods and food groups, textures, and flavours can help meet nutritional requirements*
Fruits and vegetables	Consumption of a variety of fruits and vegetables*
Vegetarian and vegan diet	Plan diet carefully. Inconsistent recommendations for fortifying for vegans
Potentially food allergy and coeliac disease	Potentially allergenic foods should not be delayed beyond 6/12, including eggs*. Peanuts - no consistent recommendations
Iron	Importance of iron-rich complementary foods* age of introduction not consistent. Formula-fed infants be given iron fortified infant formulas until at least 6 months of age.Generally no irons supplements to be given. Care with iron for vegans
Vitamin D	Vitamin D supplementation for breastfed and formula fed infants.* (not Australia)
Other nutrient supplements	Not needed for infants and young children consuming a healthy, varied diet
Fluoride supplementation	Depends on the fluoride status of the water supply
Dietary fat	Importance of diets with adequate fat content. Recommending against foods high in saturated and/or trans fats, Consistent in recommending plant oils

Some Newer Reviews on Breastfeeding

1. Binns Lee Scott (2021) The UN Sustainable Development Goals. "Transitioning to Good Health and Well-Being: The Essential Role of Breastfeeding"
2. Binns Lee et al "Climate Change, Food Supply, and Dietary Guidelines." Annu Rev Public Health. (2021).
3. Binns Lee et al "Public Health Impact of Breastfeeding". Encyclopaedia of Global Public Health D. McQueen. New York Oxford University Press: (2019). 1-46.
4. Lee Binns. "Breastfeeding and the Risk of Infant Illness in Asia: A Review." Int J Environ Res Public Health (2019) 17(1).
5. Binns Lee Low "The Long-Term Public Health Benefits of Breastfeeding" 2016 Asia Pac J Public Health
6. Binns Lee "Exclusive breastfeeding for six months: the WHO six months recommendation in the Asia Pacific Region." Asia Pac J Clin Nutr (2014). 23(3): 344-350.
7. Binns Lee Scott et al "Infant Feeding Guidelines for the Asia Pacific Region." Asia Pac J Public Health 2018 40(8): 682–690.
8. Binns Lee et al "Guidelines for Complementary Feeding of Infants in the Asia Pacific Region." Asia Pac J Public Health (2020) 32(4): 179-187.
9. "Dietary Guidelines for the Asia Pacific Region." Asia Pac J Public Health (2017). 29(2): 98-101.

This Surgeon General's report is less well known than the Smoking Report– but we hope it will have as great an impact as the Smoking and Health Report



THE LANCET

The Lancet Breastfeeding series 2016 Citations ++

Key messages

- The world is still not a supportive and enabling environment for most women who want to breastfeed.
- Countries can rapidly improve breastfeeding practices by scaling up known interventions, policies, and programmes.
- Success in breastfeeding is not the sole responsibility of a woman—the promotion of breastfeeding is a collective societal responsibility.
- The breastmilk substitute industry is large and growing, and its marketing undermines efforts to improve breastfeeding.
- The health and economic costs of suboptimal breastfeeding are largely unrecognised. Investments to promote breastfeeding, in both rich and poor settings, need to be measured against the cost of not doing so.
- Political support and financial investment are needed to protect, promote, and support breastfeeding to realise its advantages to children, women, and society

Lancet Breastfeeding Key messages

- Breastfeeding
  - Less infectious morbidity and mortality,
  - fewer dental malocclusions,
  - higher intelligence
  - overweight and diabetes later in life.
- Breastfeeding benefits mothers. Breast cancer, ovarian cancer, birth spacing, reduced diabetes
- **The scaling up of breastfeeding can prevent an estimated 823000 child deaths and 20000 breast cancer deaths every year.**
- Breastmilk is a personalised medicine for infants.
- Breastfeeding promotion is important in both rich and poor countries alike, and might contribute to achievement of the Sustainable Development Goals.

Victora Lancet 2016

Many short term benefits of breastfeeding: Less infection

Overall, breastfeeding when compared to the use of infant formula, is associated with significantly lower rates of diarrhoeal disease and lower respiratory tract infection, with a reduction of 50% or more to be expected, especially in infants under six months of age.
6/12 Exclusive Breastfeeding promotes best response to infants immunisations.

Breastfeeding in maternal infections is usually OK – but local policies vary

Tuberculosis	
HIV	
COVID	OK. (also vaccine OK during pregnancy – but not registered for this in Australia)
Hep B	Vaccinate and wait 48 hours
Hep C	treat before pregnancy
HTLV1	Being debated. Breastfeeding is probably less of a risk

Lee Binns 2020 Breastfeeding and the Risk of Infant Illness in Asia: A Review. IJERPH

Many short term benefits of breastfeeding

A. Infant formula may be contaminated by incorrect preparation or storage. I still recommend boiled water. (not bottle water as it has no fluoride)

In addition, a known contaminant of formula powder is Chronobacter (formerly Enterobactor) sakazakii. (Fortunately fairly rare)

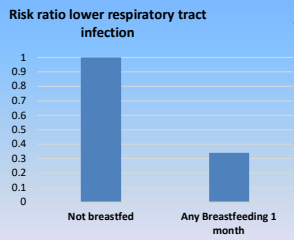
B. Cohort study in Denmark. Significant reduction in admission to hospital from infection. EBF offers more protection (n=812)

Christensen N, Bruun S, Sondergaard J, et al. Breastfeeding and Infections in Early Childhood: A Cohort Study. *Pediatrics.* 2020;146(5).

Lee Binns 2020 Breastfeeding and the Risk of Infant Illness in Asia: A Review IJERPH

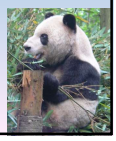
Many short term benefits of breastfeeding

Predictors of the prevalence of lower respiratory tract infection by six months postpartum in Chengdu.



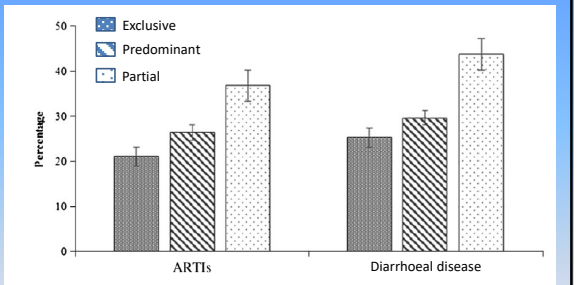
Any breastfeeding' for at least one month
(no BF =1) RR = 0.34 (0.15-0.79)
ie 60% fewer respiratory infections

Introduction of solid food 4 months or later decreases LRTI
RR = 0.33 (0.17-0.77)



(n=845. Yu, Binns 2015, J. Child Health Care.)

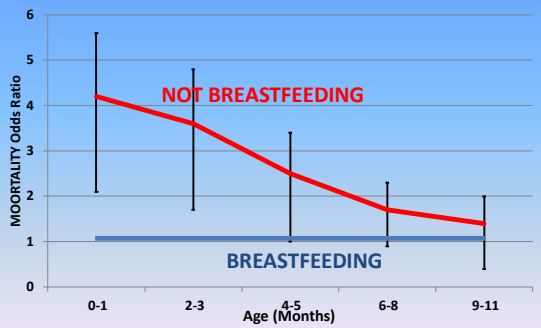
Short term benefits of breastfeeding (Maldives)



Exclusive, predominant and partial breastfeeding, data to 3 months
Effect on acute respiratory tract infections and diarrhoeal disease

(n=458. Raheema Binns 2017 J. Paed Child Health)

Infant mortality increased if "Not breastfeeding"



WHO Collaborative Study Team on the Role of Breastfeeding on the Prevention of Infant Mortality (2000). "Effect of breastfeeding on infant and child mortality due to infectious diseases in less developed countries: a pooled analysis." Lancet 355(February 5): 451-455.

Early childhood infections can have long term effects:

Frequent respiratory infections are related to asthma (?causal)

Use of antibiotics (and omeprazole) results in changes in microbiome.

The microbiome may have important effects on other chronic diseases. (obesity, diabetes etc)

Longer breastfeeding promotes a healthier microbiome.

Use antibiotics very sparingly in infants (breastfed infants rarely need them)

Asthma

Several recent reviews support a relationship[between breastfeeding and lower rates of asthma.

CDC reports that ~8% of the US population suffers from asthma

31,335 articles found on infant milk-feeding practices and allergies. asthma 73 articles.
21 studies 'never' versus 'ever' being fed human milk and asthma in childhood.
Moderate evidence suggests that feeding human milk for short durations, or not at all, is associated with higher childhood asthma risk. (25% reduction)

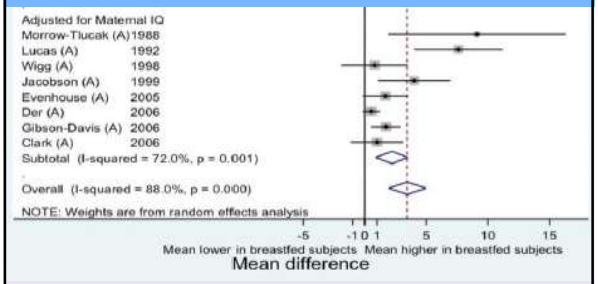
Gungor AJCN 2019

Breastfeeding offers some protection against Helicobacter pylori infection, particularly in less economically developed families

Helicobacter pylori: Warren and Marshall (Nobel Prize)
Demonstrated the importance of H pylori in
Gastric inflammatory diseases and neoplasms

Carreira H, Bastos A, Peleteiro B, Lunet N. Breast-feeding and Helicobacter pylori infection: systematic review and meta-analysis. *Public Health Nutr.* 2015;18(3):500-520.

Breastfeeding and IQ. WHO 2013. A significant advantage IQ increased 3.45 (1.92; 4.98)



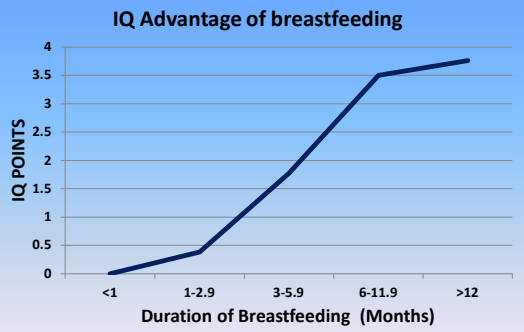
Horta, Victora WHO Long Term Advantages P63

Association between breastfeeding and intelligence, educational attainment, and income at 30 years of age: a prospective birth cohort study from Brazil (n= 5914 neonates, 3493 followed up)

Infants breastfed for 12 months or more had:

1. **Higher IQ scores (difference of 3·76 points, 95% CI 2·20–5·33),**
2. **More years of education (0·91 years, 0·42–1·40),**
3. **Higher monthly incomes (341·0 Brazilian reals, 93·8–588·3)** Victora et al. 2015, Lancet Global Health

Duration of breastfeeding is associated with children's IQs at 6 years (n=1080, Spain . Bernard *J Pediatr 2017*



Victora et al. 2015, Lancet Global Health

Breastfeeding and IQ

Ireland – lowest breastfeeding rates in Europe)
Lenehan 2020 Cork (Ireland) Cohort. At five years of age predominately breastfed at 2 months of age, overall IQ (2.00 points (95% CI: 0.35 to 3.65); *P* = .018) compared to never breastfed.

Denmark – high breastfeeding rates (>99%)
Strom (2019)1782 mother–child pairs sampled from the Danish National Birth Cohort
Compared with children who were breast fed ≤1 month, children breastfed for 2–10 or more months had IQ 3.5 points higher at 5 years

Korea n=1752 followed for 8 years. cognitive development was improved in children that were breastfed for > 3 months. (Kim 2020)

No matter how infant formula manufacturers modify their product breastfed babies have higher IQs

Nutrition to Optimise IQ and stay alert throughout life

Breastfeeding
Iodine
Iron
Malnutrition (stunting)

Healthy diet (fruit veges etc and exercise
?slow Alzheimers
(folic acid, tea)

SIDS 2016, 17,

SIDS protective factors include:

Breastfeeding,
Pacifier use,
Room sharing, bassinet next to the bed - not in the same bed.
Sleeping on back
Immunisations

Carlin 2017 JAMA Pediatrics
Smith 2016 American Academy of Pediatrics

SIDS 2016, 17,

SIDS and Breastfeeding

Any Breastfeeding> 2 months is protective
The longer breastfeeding the more protection

Thompson 2017. Duration of Breastfeeding and Risk of SIDS: An Individual Participant Data Meta-analysis. Pediatrics

More on SIDS

Carlin 2017 Risk Factors, Protective Factors, and Current Recommendations to Reduce Sudden Infant Death Syndrome A Review JAMA Ped.

"Breastfeeding as much as possible and for as long as possible is recommended."

Protective factors include breastfeeding, pacifier use, room sharing, and immunizations.

Obesity is increasing everywhere (Japan least)

Review of Obesity in Children in China

Based on the available data - obesity in children in China has increased above its historical levels.

1980s	1-2% obesity
2010s	20% is not unusual in cities.
2014	23% in boys

Because consistent criteria for classification have not been used and age-adjusted data are not available, it is difficult to accurately quantify numbers and trends.

There is a need for a consistent approach to the measurement of obesity.

(Chen, Binns 2012 Asia Pacific J Public Health)

Don't ask Mothers: measure and monitor weight

Mothers perceptions of the status of their overweight/ obese (BMI) children in Australia and China. Aust n=239 China n=1700 (16% were overweight or obese)

Only 10% of children who were overweight or obese were correctly classified by their mothers!

Australian Chinese mothers (Perth).

75% of overweight or obese children were thought by their mothers to be normal. (12% thought to be **underweight**!!)

Chinese mothers (Chengdu).

70% of overweight or obese children were thought by their mothers to be normal. (18% as underweight)

Chen Binns 2014 APJCN

We need to change parents perceptions of infant's weight.

Measure – don't listen to grandma!

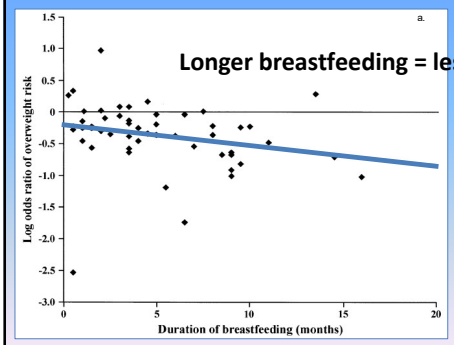
Deal 2020

The prevalence of obesity among youth in the USA is currently >18% with projections that more than half of today's children will be obese as adults. Growth trajectories for obesity are established in infancy and early childhood, and track into adulthood. Children who are obese at 5 years are more likely to be obese adults.

Tambalis (2018) Cohort n= 5125 exclusive breastfeeding 6 months or more (versus never) was associated with a decreased risk of childhood and adolescence obesity by 30% and 38% (95% CI, 0.40–0.83), respectively. Exclusive breastfeeding had a favorable influence on offspring's overweight and obesity not only in childhood but also in adolescence/adulthood

Singhal (2020) **Faster infant growth has been associated with later obesity in many studies, including five randomized trials. There have been several systematic reviews supporting the positive effects of breastfeeding on cardiovascular risk factors, such as obesity and type 2 diabetes.**

Each month of breastfeeding decreased of obesity by 4% (up to 9 months or 36%)



OR=0.96/month of breastfeeding, 95% CI: 0.94, 0.98).

Harder T, et al. Am J Epidemiol.2005;162(5):397-403.

Breastfeeding and Obesity

It is far easier to prevent obesity than it is to treat it and so the public health emphasis should be on prevention.

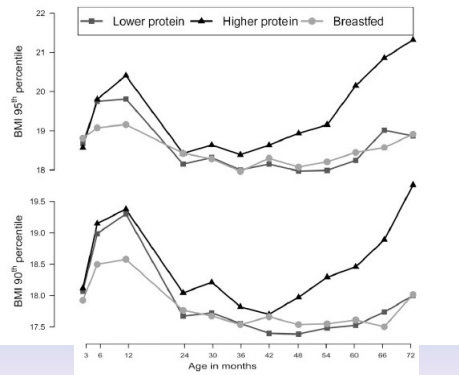
"The first step in an obesity prevention program is to ensure that all mothers have the opportunity to breastfeed their infants, exclusively for six months and then continuing while complementary feeds are introduced. Infants who are not breastfed are 33% more likely to become obese children."

(The Surgeon General's Call to Action to Support Breastfeeding. Washington, DC: Department of Health and Human Services Office of the Surgeon General 2011.)

Weigh and plot regularly and accurately

1. **Weight. For a longer healthy life 10-50%ile is probably best**
2. **Trajectory. Steady growth in parallel with 50th percentile**
3. **Colic Example: Boy 3.2kg at birth. Mother said no milk and put him on a bottle. Cried continuously. Mother was desperate and said the child was very ill.**
   a. **Weight >90th percentile**
   b. **Had already been on 6 different formulas**
   c. **Try Probiotic (Lactobacillus reuterii)**
   d. **Grow older**
   e. **Reassurance from an experienced nurse**

Infant formula and obesity



Weber Koletzko 2014 The European Childhood Obesity Trial Study Group 6 year follow-up AJCN

One of the best predictors of later obesity risk is weight gain during the first year of life. The rapid weight gain in formula-fed infants might be mediated through an enhanced secretion of insulin and insulin-like growth factor I (IGF-I).

Insulin and IGF-I concentrations are greater in formula-fed than in breastfed infants. (protein quantity and quality).

IGF-I concentrations in early life have been linked to concentrations in later childhood and adulthood.

The Better Infant Formula (breast is best)

Breastmilk 0.9-1.0% protein
Low Protein (the best to reduce obesity)
Probiotic Gold 1.1-1.3% More ecpensive

Higher Protein: > 1.5%
A2, Organic, "house brands", cheaper brands

Highest:
Soy, Goat (don't use)- limited special use only

The Better Infant Formula- lower protein

The original European Child Obesity study on infant formula (high and low protein) found a higher protein content of infant formula is associated with higher weight in the first 2 years of life but has no effect on length. Lower protein intake in infancy might diminish the later risk of overweight and obesity. Koletzko et al AJCN 2009

Confirmed in a recent study: The minimum protein amount of the current European legal standards for infant formula, 1.2–1.7 g protein/100 mls, can be adjusted to lower amounts if protein quality is further improved.
Reduces the later risk of childhood obesity

Kouwenhoven, Koletzko et al (2020). "A modified low-protein infant formula supports adequate growth in healthy, term infants: a randomized, double-blind, equivalence trial." American Journal of Clinical Nutrition 111(5): 962-974.

Galactogues

No recent trials or reviews
Domperidone (Motilium)
Metoclopramide (Maxolon)

Best article is the Academy of Breastfeeding Medicine Protocol

ABM Clinical Protocol #9: Use of Galactogogues Second Revision 2018." Breastfeeding Medicine **13**(5): 307-314

Colic

Persistent infant colic:
- parental fatigue ,
- distress
- strained parental relationships
- poor parental engagement with their infant.
- (and upsets GPs and nurses)

Crying daily is normal in developing infants, with the duration increasing from birth and peaking at approximately 6 weeks.
Harb 2016 Hjerb 2020

Incidence of crying/reflux peaks at as high as 20-50% at 3-6 months (so is it the norm?)
Another estimate 5-19% (Qubty 2016)
20% Hjerb (2020)

Warning signs of more serious disease:

- Bilious vomiting
- GI tract bleeding, Hematemesis
- Consistently forceful vomiting
- Fever
- Lethargy
- Hepatosplenomegaly
- Bulging fontanelle
- Macro/microcephaly
- Seizures
- Abdominal tenderness or distension
- Documented or suspected genetic/metabolic syndrome
- Associated chronic disease

What are we dealing with – better definition needed

Review of 39 trials on colic: 20 different definitions Steutel 2014.

"Infant colic" - a collection of symptoms, including
persistent crying, fussiness, unable to settle or self sooth and sometimes unable to feed properly.

.

Infant colic has been defined since 1954 as
"crying for>3 hours per day, for>3 days per week, for a period of 3 weeks or longer in otherwise healthy infants"; the Wessel "rule of threes"

Rome III recognised as a functional gastrointestinal disorder of infancy and set these criteria to define infant colic as:

- crying for >3 hours per day,
- for >3 days per week,
- for at least 1 week,
- with no failure to thrive .

20% meet these criteria at 6 weeks Harb 2016

PPIs (protein pump inhibitors)

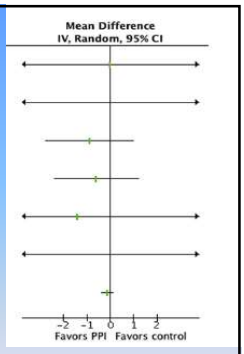
Systematic review of all 6 RCTs of PPIs in management of colic. Mostly measured length of crying time.

No effect difference

Increased rate of Respiratory and Gastrointestinal infections

Gieruszczak-Bialek J Peds 2015

Risk – PPIs eg omeprazole (Losec) reduce acid secretion, modify microbiome and increase risk of infectious disease in infants



"There is broad consensus in reviews that there is no indication for pharmacological treatment, such as proton pump inhibitors (PPIs) or prokinetic drugs, in infants with infantile colic or regurgitation, even if these are showing signs of distress. These reviews suggest that there is either no evidence of the effectiveness of pharmacological treatment or evidence of no effect, and there can be significant risks and negative side effects." Glanville 2016

The Microbiome and colic

Probiotics 'live microorganisms that, when administered in adequate amounts, confer a health benefit on the host'

Colic: Decreased microbial diversity and increased anaerobic bacteria

Alterations of gut microbiota play a role in the pathogenesis of infantile colic. Could probiotics help?

Lactobacillus reuteri DSM 17938

Four RCTs showed that use of L reuteri reduced crying times in breastfed infants with infantile colic. One RCT with both breast- and formula fed no effect. Szajewska 2016, Slattery 2016

Meta-analysis of 3 RCTs found that compared with placebo, the administration of L Reuteri reduced crying time on day 21 by approximately 43 minutes (95%CI 19,68) including breastfed infants. Urbanska 2014.

Fatheree 2017 J Pediatrics

In this pilot randomized clinical trial, we found no significant changes in important safety and immune markers in infants with colic treated with probiotics. A strength of this study was the very careful follow-up of population of breastfed infants with colic.

Conclusions Daily administration of L reuteri (strain DSM 17938) appears to be safe in newborn infants with colic, including those with neutropenia, which frequently coexists. A placebo response of 66% suggests that many infants with colic will have resolution within 3 weeks.

Colic Conclusion: what doesn't work

PPIs (omeprazole etc)
- **Increase respiratory and GIT infections**
- **Change the microbiome**

Other motility drugs (dicyclomine – deaths!)
Antacids, simethicone
Stopping breastfeeding
Switching formula (no specific formula works)

Hjerb 2020
There is moderately strong evidence that administration of the probiotic Lactobacillus reuteri DSM 17938 can shorten crying duration in infants with colic, while the available evidence does not support acupuncture for colic.
• There is a need for evidence-based parent support strategies for infantile colic. Such strategies should also include the second parent.

Colic Conclusion: what doesn't work

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- **Increase respiratory and GIT infections**
- **Change the microbiome**

Other motility drugs (dicyclomine – deaths!)
Antacids, simethicone
Stopping breastfeeding
Switching formula (no specific formula works)

Colic Conclusion: what does work

Breastfed infants cry less (?more body contact)
Time is the best cure
Probiotic Lactobacillus reuteri DSM 17938 (Moderate evidence) can shorten crying
Parent support strategies for infantile colic. Include both parents

Colic Conclusion

'Should we be treating infantile colic at all?' Parents, researchers, GPs and nurses may have different opinions.

Breastfed infants cry less (more body contact)

Time is the best cure

Probiotics may help in reducing symptoms and perhaps in prevention.

For breastfed infants:

Probiotic preparations for infants (L reuteri now available in Australia)

Try giving probiotics to mothers. (probiotics are present in breastmilk)

?Mothers diet modification (avoid garlic, capsicum, alcohol, chocolate etc) no studies that I am aware of, but we know its important!.

Bottle fed:

Probiotic formula

Cuddles and Time are the best cures

Probiotics and children

Currently there are no recommendations to use pre- or probiotics for:

Treatment of food allergy ,

Prevention of food allergy, allergic rhinitis, and asthma.

Prevention of eczema in high risk infants –conflicting evidence. S Koletzko 2016

Colic – probable –see above

Prevention and treatment of diarrhoeal disease – evidence that they work – CUPDAY study

The CUPDAY Study

The Curtin University Probiotics in Day Care Study

N=496

5 months over winter

Triple blind cluster randomised study

Binns et al The CUPDAY Study: Acta Paediatrica 2007

CUPDAY results

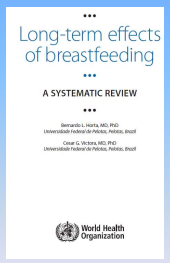
For the analysis diarrhoea was defined as 4 or more stools per day.

1. The trial group had significantly fewer days with four or more stools, a reduction of approximately 20% in diarrhoeal rate, after accounting for the effect of confounding variables.
2. Less otitis media ($p<0.05$)
3. Fewer days too ill to attend Childcare

Trial group Average 5.7 days (Total 1293 days)

Control group Average 6.4 days (Total 1430 days)

Long-term effects on infant health: reduced risk of chronic diseases (WHO)



Meta analyses showed the effects of breastfeeding later in life:

- **Breastfeeding significantly reduced the risk of obesity**
- **Breastfeeding reduced the risk of type 2 diabetes**
- **There was a small protective effect of breastfeeding against systolic blood pressure**
- **Breastfeeding was associated with higher performance in intelligence tests**

http://www.who.int/maternal_child_adolescent/documents/breastfeeding_long_term_effects/en/

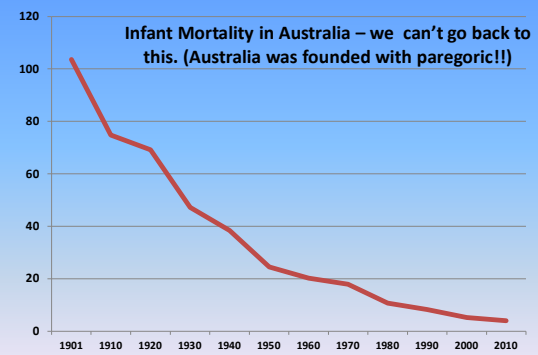
Theories of allergy: why the increase

Hygiene Hypothesis – lack of exposure to external micro-organisms decreases natural immune development and predisposes to allergy later in life (and ?chronic disease)

Microbiome hypothesis – alteration of the commensal gut microbiota – allergy etc.
(Normal microbiome through vaginal delivery, breastfeeding etc)

Infant Feeding Guidelines (2013) Solids around 6 months. Variety.
(Confirmed by the Allergy Specialists)
Most studies confirm breastfeeding is important

Hygiene hypothesis? Be careful what you wish for!



Don't forget how much good the community nurses and GPs of Australia have done in promoting infant health and monitoring growth .

Putting it all together –early life and lifelong health:

Developmental Origins of Health and Disease (DOHAD),
The first 1000 days (UNICEF) Exc Breastfeeding
Protein in infant feeding (enough - not too much)
Establish and maintain a healthy GIT Microbiome

Microbiome

The early-life microbiome develops in a clear stepwise manner over the first 3 years of life. During this highly dynamic time, insults such as antibiotic use and formula feeding can adversely affect the composition and temporal development of the microbiome. Such experiences predispose infants for the development of chronic health conditions later in life

Mode of delivery C-section 34% of infants in Aust (2015) CS delivery has been repeatedly associated with early-life gut dysbiosis

Breastfeeding many studies BF influence the development of the infant gut microbiome. BF is the most significant factor (Stewart 2018)

Stewart CJ, Ajami NJ, O'Brien JL, et al. Temporal development of the gut microbiome in early childhood from the TEDDY study. *Nature.* 2018;562(7728):583-6.
Stinson LF. Establishment of the early-life microbiome: a DOHaD perspective. *Journal of Developmental Origins of Health and Disease.* 2020;11(3):201-210.

DOHAD

Slow early growth predisposes to chronic disease later in life as an adult. Babies who are thin or short at birth are at risk (LBW<2500g, Ponderal Index <26,) or who failed to grow in infancy:

- Coronary heart disease
- Hypertension
- Diabetes
- Osteoporosis
- Chronic renal disease

Remember

rapid growth resulting in obesity is also bad (the U-shaped curve)

Worse outcome is small babies, poor early growth and later obesity.

DOHAD Some Mechanisms:

- **Metabolic Programming**
- **Growth rate – protein level and IgF**
- **Microbiome**
  - **Early contact (breastfeed <30 mins)**
  - **Exclusive breastfeeding**
    - **Human milk oligopolysaccharides**
    - **BM contains L reuterii (increase GIT permeability**
  - **Avoid antibiotics as much as possible**
- **Epigenetics – changes to DNA expression (methylation, histone modification, non-coding RNA (ncRNA)** etc.)

Antibiotics in neonates

Broad spectrum antibiotics:

- Scandinavia – 5%
- Vietnam 80%
- Australia ?

Antibiotics use associated with

- Obesity
- Increased diarrhoea
- Asthma
- NCDs

NICU – all exposures increase

Antibiotics in neonates

Maternal use of antibiotics during pregnancy was associated with an increased risk of tonsillitis reported at four years of age. Antibiotics could favour the potential transmission of an unfavourable microbiome from mother to child.

Cunha A, Santos AC, Medronho RA, Barros H. 2021 Use of antibiotics during pregnancy is associated with infection in children at four years of age in Portugal. *Acta Paediatrica.*

UNICEF First 1000 days

Conception to Two Years

"Who you are today was shaped in your first 1000 days"

Nutrition (brain uses 50%+ energy in first 2 years)

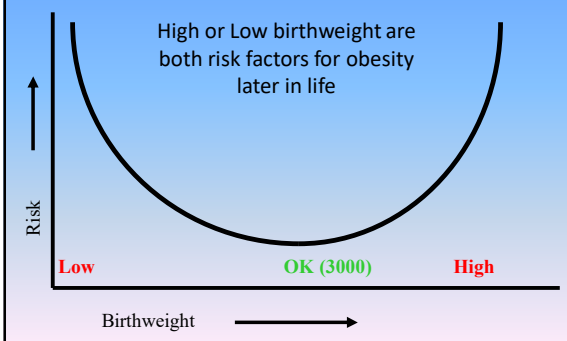
Infection

Microbiome

Stimulating psychological environment

Environmental Pollution

Birthweight is also U-shaped risk



Weight gain during pregnancy is important

U- Shaped Association

Obese mothers have higher rates of LBW (Cnattingius 2013, 1.6 million deliveries in Sweden)

Obese mothers and high rate of weight gain during pregnancy are associated with large infants and later obesity.

Obese mothers – higher rate of neonatal mortality

Underweight mothers and LBW infants are associated with later health problems (DOHAD) – heart disease, diabetes, hypertension, obesity etc.

Specific Intrauterine Growth Periods:

- Neural tube defects (6-8 weeks)
- Renal tubule development (nephrons) 7-8 months. At least a 3-fold variations in the number of nephrons
- Bones – calcium and Vit D
- Teeth – flouride
- CNS – iodine

The DOHAD Hypothesis Examples

Useful in public health.

- French Paradox (Barker)
- Australia – plunge in CHD deaths in 1970 - 80s
- Australian Aboriginal health
- Okinawa

Studies in Asia (Need more with 10-20000 records)

- India.
- China Famine – 1959-61

DOHAD

The developmental origins of health and disease were first described by Barker and Osmond in the 1980s28 and it has gone on to become a growing field of research. The theory is that adult health and disease can be explained by early life experiences, either in utero, as an infant or as a young child. The early environment includes nutrition, toxins and exposure to psychological and physiological factors or stressors.

Breastfeeding:

- Keeps weight and growth under control
- Preserves healthy microbiome
- Fewer infections (less antibiotics to destroy microbiome)

Linner A, Almgren M. Epigenetic programming-The important first 1000 days. *Acta paediatrica*. 2020;109(3):443-452

Infant Nutrition and long term health

The strongest and most consistent evidence for a protective, long-term effect is **breastfeeding.**
Limit intake of sodium and rapidly absorbed carbohydrates,
reduce consumption of saturated fatty acids (replace) with polyunsaturated fatty acids,
lower intake of trans fatty acids

(Zalewski Koletzko et al 2017)

Breastfeeding also benefits the mother

Reduced Ovarian Cancer

(The Curtin SoPH is a member of the Oxford Collaboration on Ovarian Cancer)

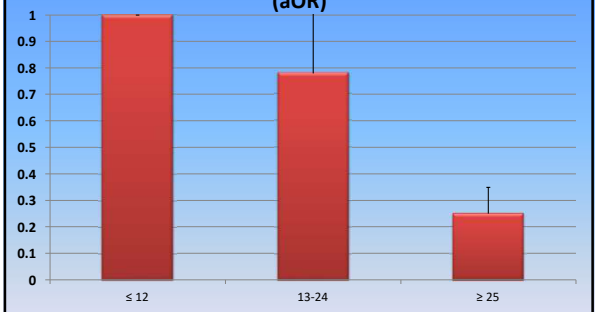
Reduced Premenopausal Breast Cancer (Anstey 2017)

Reduced Obesity

Reduced Type 2 Diabetes

Reduced osteoporosis fractures – Reduced 1% each month of lifetime breastfeeding (Duan et al Osteoporosis International 2017)

Ovarian Cancer and total breastfeeding duration (aOR)



Zhang Lee Binns Eur J Canc Prev 2004
Su D, Pasalich M, Binns CW, Lee AH . American J Clinical Nutrition 2013

Ovarian Cancer and total breastfeeding duration

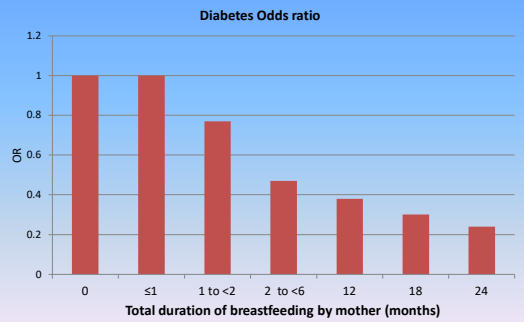
Breastfeeding is associated with a significant decrease in risk of ovarian cancer overall and for the high-grade serous subtype, most lethal type) Pooled Analysis 9973 women with ovarian cancer 13 843 controls (

Breastfeeding associated with a 24% lower risk of invasive ovarian cancer (odds ratio [OR], 0.76; 95%CI, 0.71-0.80).
Mean breastfeeding duration of 1 to 3 months -18% lower breastfeeding for 12 or more months - 34% lower risk

Reduction persisted for decades (30 years)

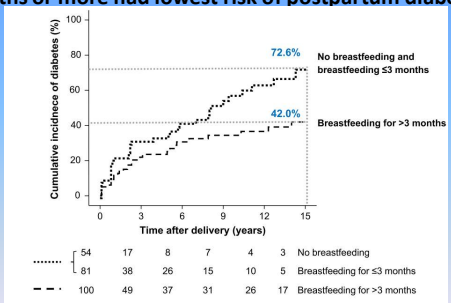
Babic A, Sasamoto N, Rosner BA, et al. Association Between Breastfeeding and Ovarian Cancer Risk. *JAMA Oncology.* 2020;6(6)

Longer duration of breastfeeding is related to a lower risk of diabetes in mothers (weight loss may be confounder)



Jäger S, et al. Metanalysis of breastfeeding diabetes Diabetologia. 2014;57(7):1355-65.

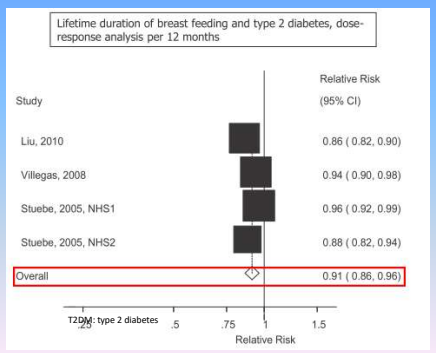
Women with Gestational Diabetes who breastfed for 3 months or more had lowest risk of postpartum diabetes



To investigate whether breastfeeding influences short- and long-term postpartum diabetes outcomes, women with GDM (n = 304) participating in the prospective German GDM study were followed from delivery for up to 19 years postpartum for diabetes development.

Ziegler AG, et al. Diabetes. 2012;61(12):3167-71.
Much D, et al. Mol Metab. 2014; 3(3): 284–292.

A 9% reduction in maternal risk of Type 2 Diabetes for each 12 month increase in lifetime duration of breastfeeding



Aune D, et al. Nutr Metab Cardiovasc Dis. 2014;24(2):107-15.

Women's Health Initiative (n=139681)

Lifetime history of more than 12 months of lactation:

- **Hypertension Reduced** (OR=0.88, p<0.001),
- **Diabetes Reduced** (OR= 0.80, p<0.001),
- **Hyperlipidemia Less** (OR=0.81, p<0.001)
- **Cardiovascular disease Reduced** (OR= 0.91, p=0.008)

(Compared women who never breastfed. Dose-response relationships were observed in fully-adjusted models)

Schwarz EB, et al. Obstet Gynecol. 2009;113(5):974-82.

Conclusion

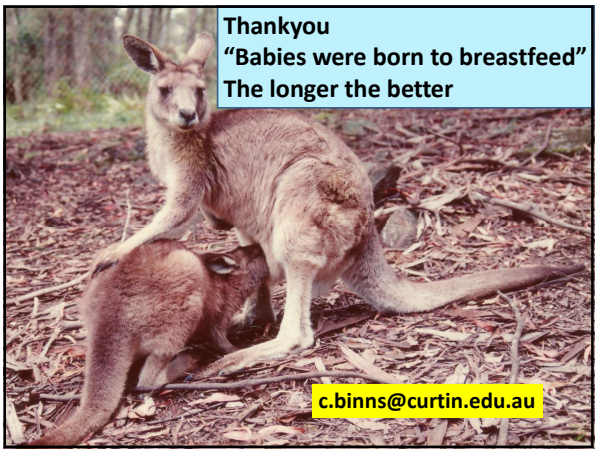
The most important priorities in health are caring for our mothers and infants.

"Babies were born to breastfeed"

GOOD: **Any breastfeeding is good**

BETTER: **Longer duration (6-12 months+) is better**

BEST: **Exclusive breastfeeding for about 6 months followed Longer duration (6-12 months+) is best**


Thankyou
“Babies were born to breastfeed”
The longer the better
c.binns@curtin.edu.au