



Infant Nutrition – What's new?

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ACKNOWLEDGEMENTS TO THE DIETITIANS AT RCH



Overview

- Growth
- Infant formula update



Growth

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Assessment of Infant Growth



- WHO growth charts
 - 0-2yrs
- Weight, length and head circumference
- Trend over time

Assessment of Growth



- **Growth charts for clinical conditions:**
 - Fenton growth charts (Premature infants)
 - Down Syndrome Growth Charts
 - Use the same chart each time
 - Turner Syndrome
 - Cerebral Palsy
 - And more.....
- **Use with caution**

Expected Growth in Infancy



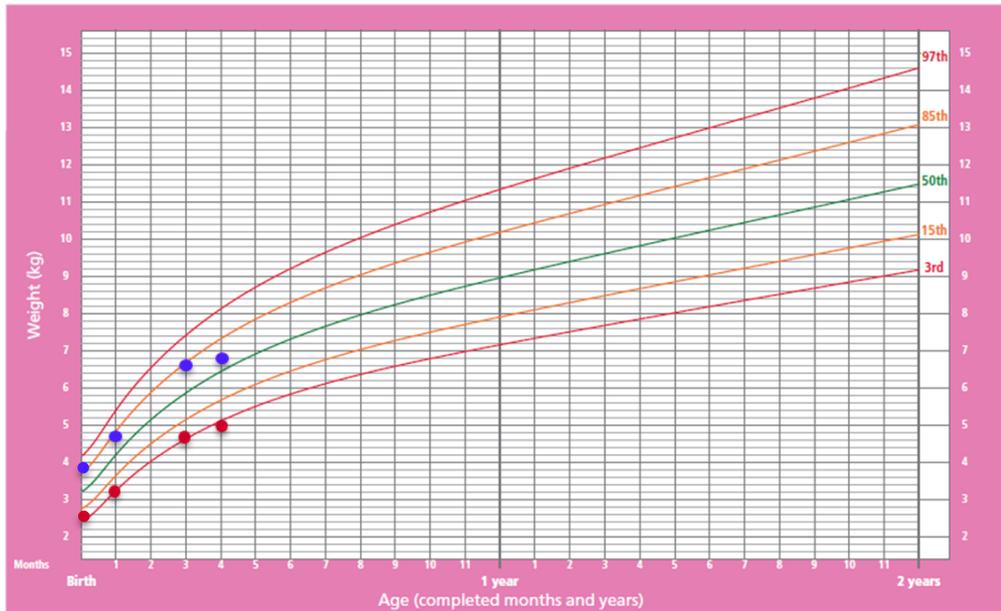
Age	Expected weight gain
0-3 months	200g/week (20-30g/day) Or 15g/kg/day
3-6 months	150g/week
6-9 months	100g/week
9-12 months	50-75g/week

Growth Consideration



Weight-for-age GIRLS

Birth to 2 years (percentiles)



WHO Child Growth Standards

- Consider growth velocity at different centiles
- Each child gains 250g in a month

 85th centile

 3rd centile

1-month weight increments (g) GIRLS Birth to 12 months (percentiles)



3 - 4 mo	133	214	259	376	448	585	726	804	937	990	1090
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http://www.rch.org.au/childgrowth/Growth_Charts/

Faltering growth



- Previously called 'Failure to thrive'
- Weight more than 2 major centiles < height
- ↓ 2 major centiles for weight or height
- < 80% weight for height
- BMI < 3rd centile
- Organic vs Non-Organic

Interpreting growth charts

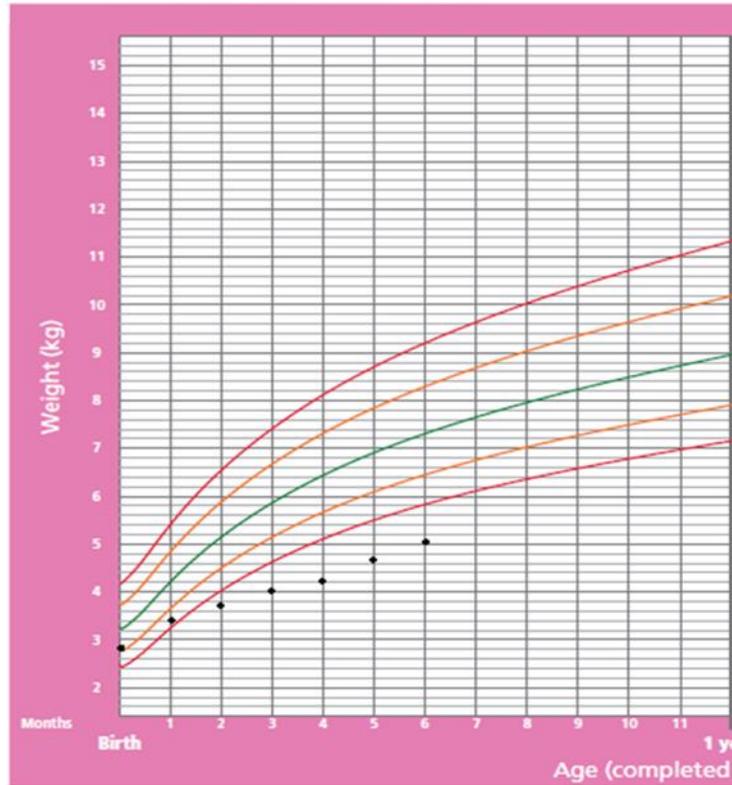


- **Low weight for height**
→ short term depletion
- **Low height for age**
→ chronic poor nutrition
- **Low weight for age**
→ further assessment



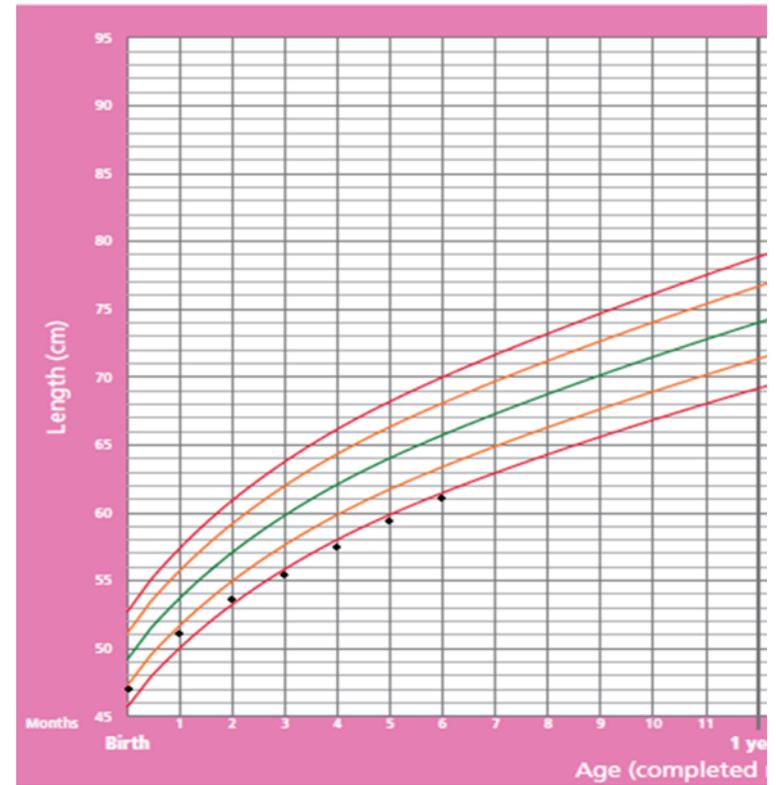
Weight-for-age GIRLS

Birth to 2 years (percentiles)



Length-for-age GIRLS

Birth to 2 years (percentiles)



Nutritional Aims



- Prevent further faltering
- Achieve catch up growth
- Establish healthy feeding patterns and behaviour
- Ensure growth and development achieved

Strategies to achieve catch up growth



- **Breastfeeding**
 - Assessment of latch
 - Regular feeding / expressing
 - Fortification of EBM
 - Formula top ups
 - Use of a concentrated glucose polymer or fat supplementation solution
 - Referral to lactation consultant

Strategies to achieve catch up growth



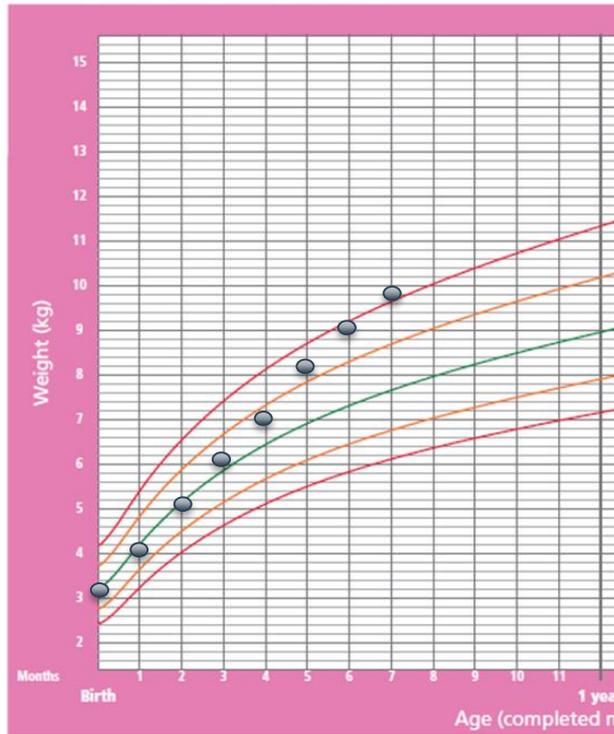
- A number of strategies to use
- Monitor weights regularly
- Refer to the dietitian

Other growth considerations



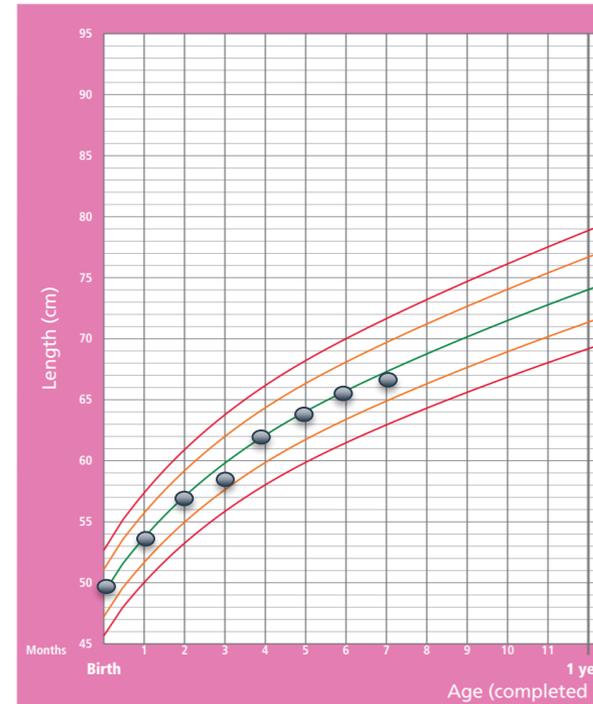
Weight-for-age GIRLS

Birth to 2 years (percentiles)



Length-for-age GIRLS

Birth to 2 years (percentiles)





Infant formulas

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Breast milk



- Easily digested
- Adapts as the infant grows
- Breast milk is difficult to replicate
- Contains immunoglobulins
- Numerous benefits
 - Lower incidence of NEC, gastroenteritis, coeliac disease, inflammatory bowel disease
 - Lower risk of childhood obesity and other cardiovascular risks

Infant formula



Formulation protected by

- Codex Alimentarius – internationally recognised set of standards for food & food safety
- **FSANZ P2.9.1**
 - Provides standards for macro- and micro- nutrient composition
 - Regulates allowable additives eg. nucleotides and other nutritive substances
 - Microbiological standards
 - Quality, composition and labeling of formula
- **Currently undergoing a review**

Marketing in Australia of Infant Formula (MAIF)



- WHO developed international code of marketing of breast-milk substitutes in 1981
- Australia's response to the WHO code
- Voluntary self-regulating agreement to signatories
- Contribute to the provision of safe and adequate nutrition for infants:
 - Protection & promotion of breastfeeding
 - Proper use of breastmilk substitutes
 - Appropriate marketing & distribution
 - Contact with health professionals

ESPGHAN Global Standard for Composition of Infant Formula



- Infant formula should “contain components in amounts that serve a nutritional purpose or provide another benefit. The inclusion of unnecessary components may put a burden on metabolic and other physiological functions of the infant”

(Koletzko *et al*, 2005)

- Energy; 250-295kJ/100ml
- Protein; 1.8-3g/100cal (1.2-2.0g/100ml)
- Iron minimum 0.1g/100kJ

Protein content



Breastmilk is protective against later obesity

Protein is thought to be a key factor

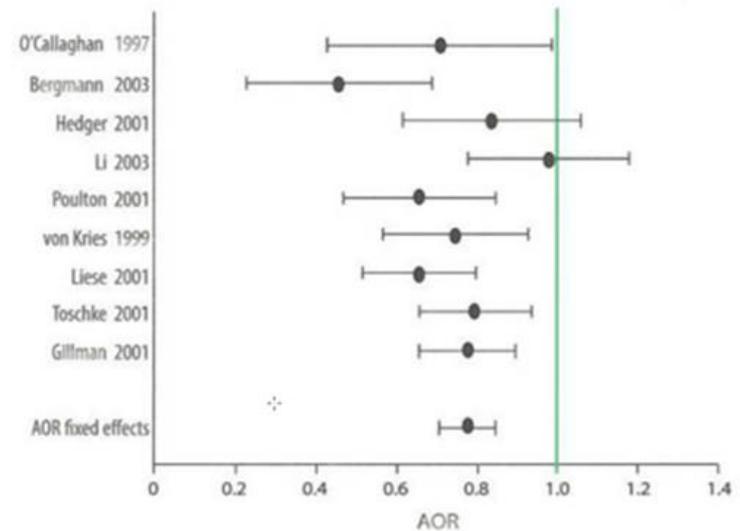


Fig. 1. Effect of breastfeeding vs. formula feeding on childhood obesity: covariate-adjusted odds ratios of 9 studies and pooled adjusted odds ratio (AOR). (Adapted from Koletzko, 2006¹).

Protein in Infancy

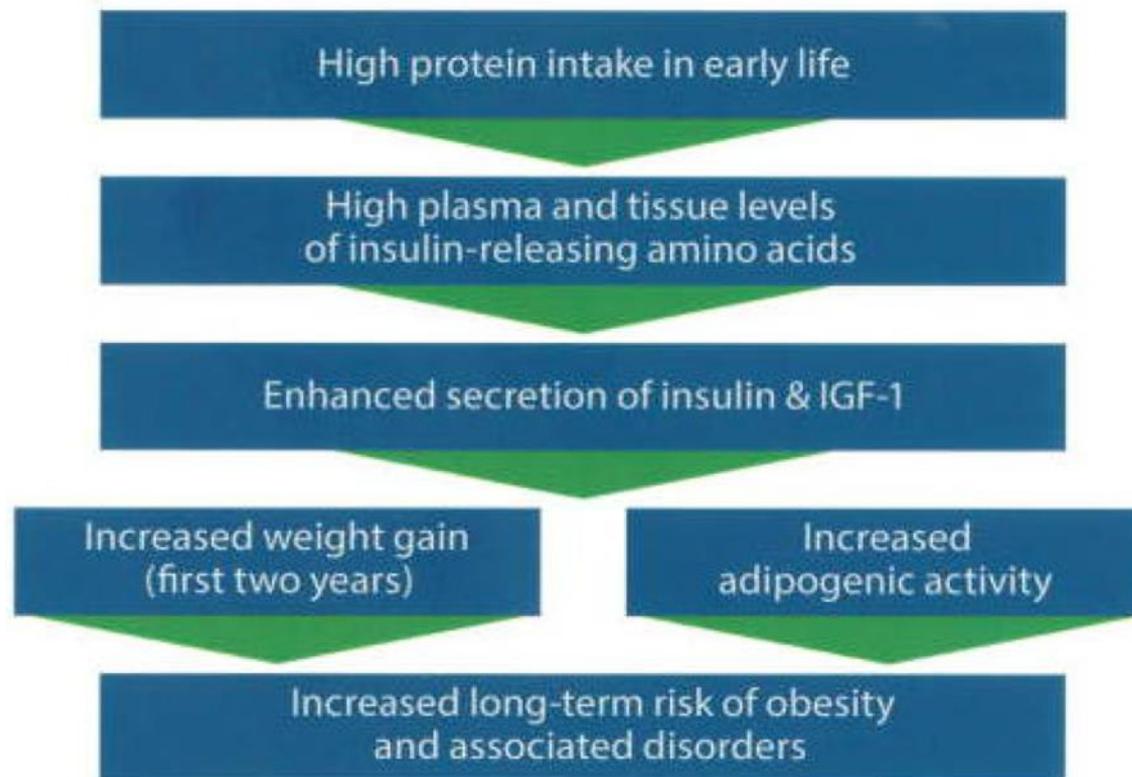


Fig. 2: The Early Protein Hypothesis (Adapted from Koletzko et al. 2011²)

Protein in Breast milk



Evolution of Protein Content in Breast Milk

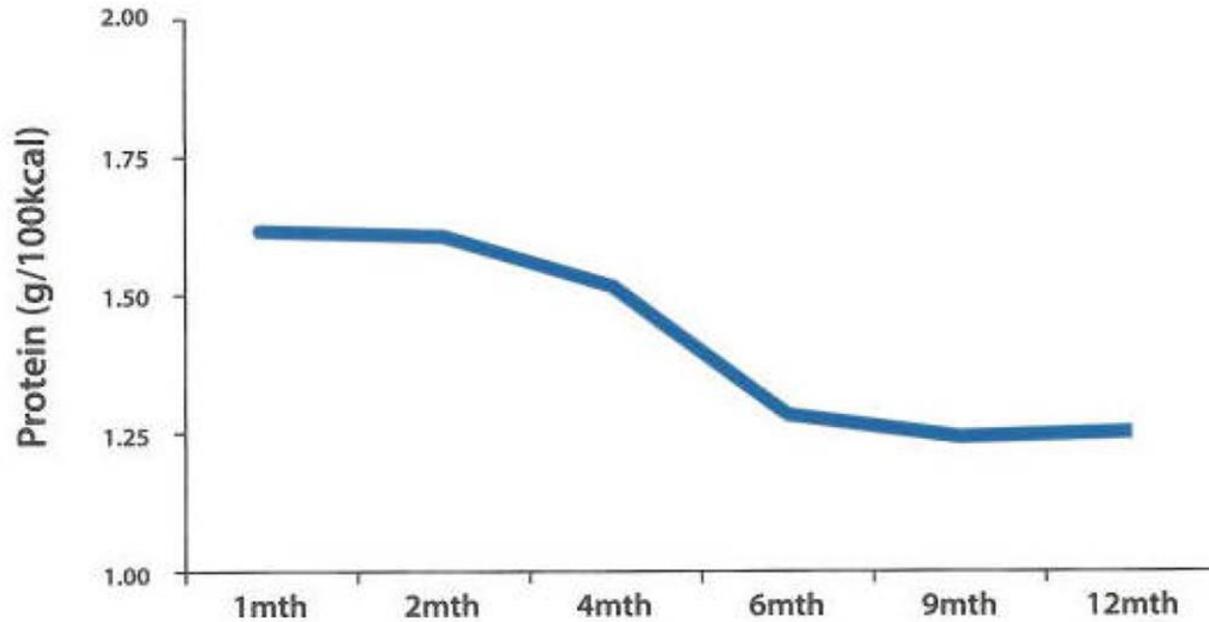
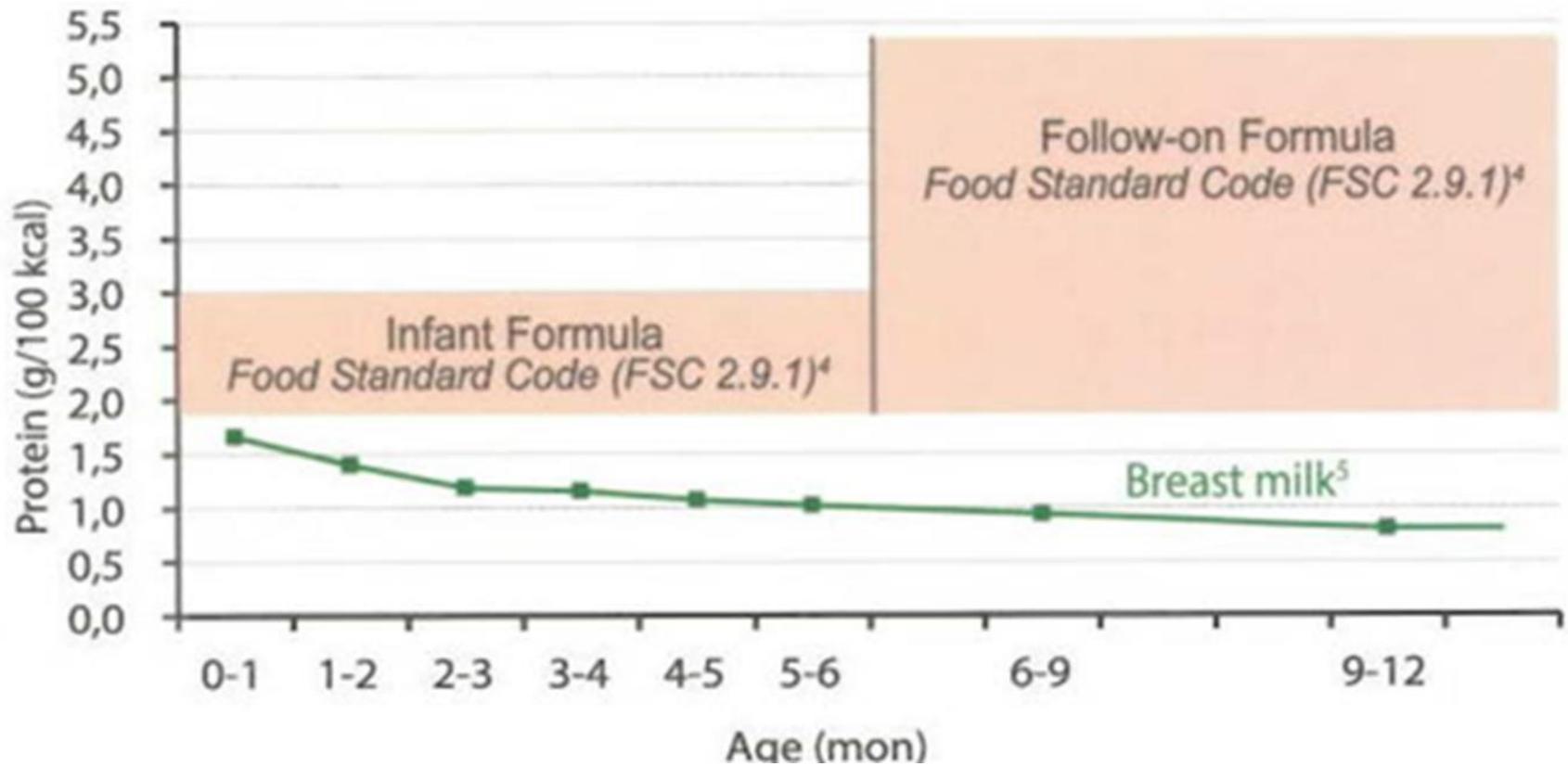


Fig. 3. Protein content changes over the first year - Australian human milk. (Adapted from Mitoulas et al. 2002³)

Protein in Infant Formula



How much protein are infants having?

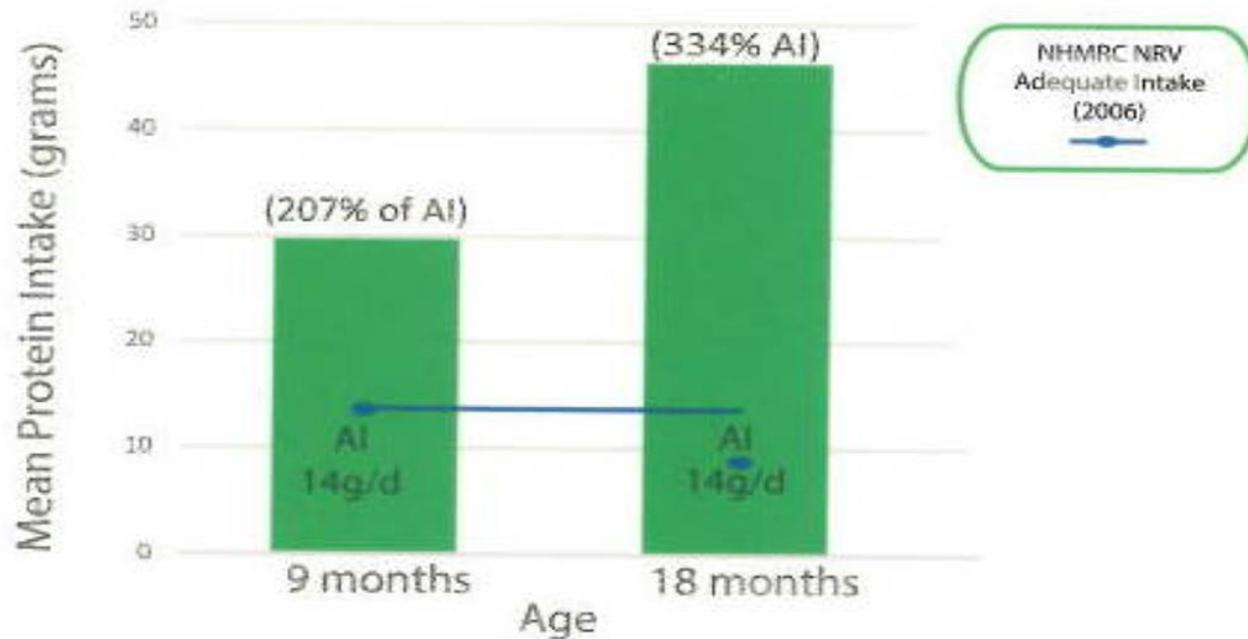


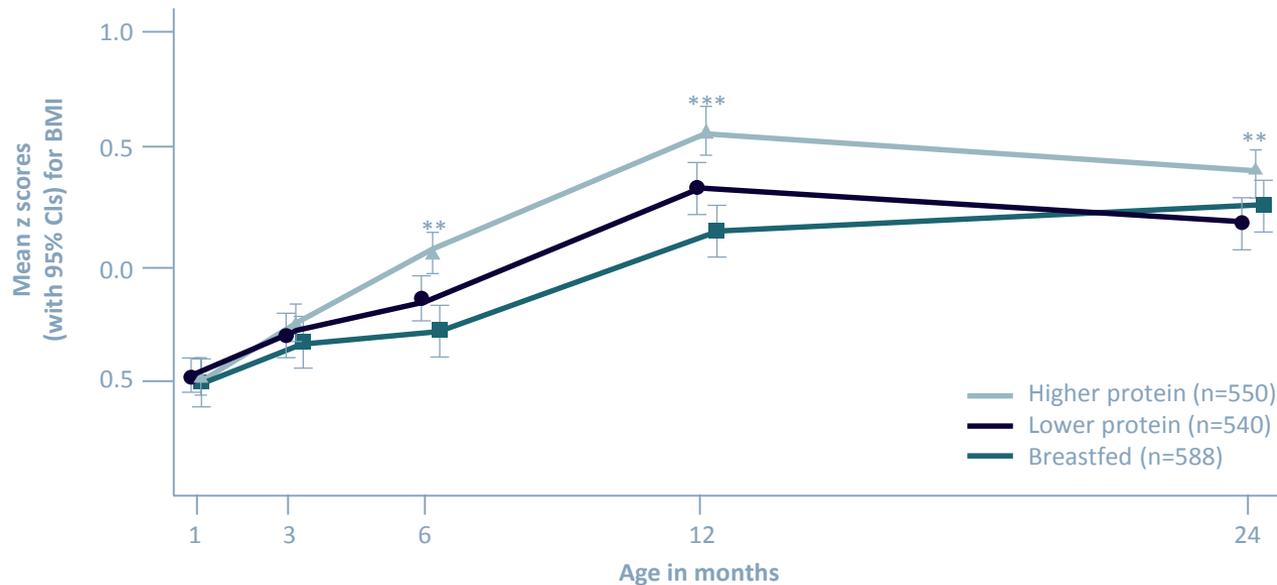
Fig. 6: Average protein intake at different age points.
(Adapted from Lioret et al. 2012⁸)



Benefits of lower protein quantity

Lower protein quantity resulted in a BMI z-score closer to breastfed infants at 6, 12 and 24 months

Mean z scores (with 95% CIs) for BMI in children at baseline (0–8 weeks of age) and at 3, 6, 12, and 24 months of age



Adapted from Koletzko 2009. **, ***Significantly different from the lower-protein group (ANOVA adjusted for baseline value): ** $p < 0.01$, *** $p < 0.001$. Double-blind, randomised controlled trial comparing two groups of children each fed 2 types (standard and follow-on) of cow's milk-based formula with either a lower or higher protein content for the first year of life. Both groups were compared with an observational breastfed group. The formulas differed in the content of cow's-milk protein (2.05 vs with 1.25 g/dL in infant formula and 3.2 vs with 1.6 g/dL in the follow-on formula, respectively) but had identical energy contents achieved by adjustment of total fat content. All other compositional aspects of the two types of formula were similar.

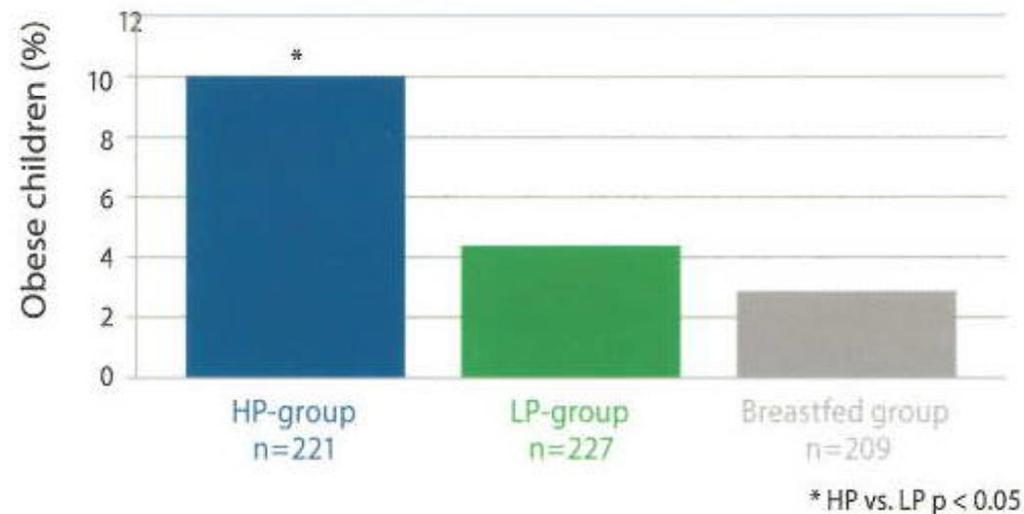
BMI: body mass index; CI: confidence interval

Benefits of lower protein quantity



Reducing the protein content of infant formula does make a difference.

Fig. 9: Obesity at the age of 6 years: Children in the HP-group have 2.43 times the risk of those in the LP-group of being obese at the age of 6 years



(Adapted from Weber et al. 2014¹⁰)

NHMRC Recommendations



- NHMRC have recommended that a lower protein formula is preferable for formula fed babies.
- A number of companies have reduced the protein content of their infant formula closer to that of breast milk



Other additives



- Long Chain Polyunsaturated Fatty Acids (LCPUFA)
- Nucleotides
- Lutein
- Probiotics
- Prebiotics

LCPUFA

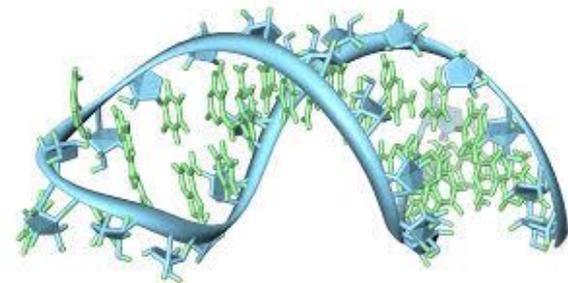


- AA and DHA are long chain polyunsaturated fatty acids present in large amounts in breast milk (0.32%±0.22%)
- Considered to play a crucial role in eye and brain development.
- DHA is a bioactive omega-3 polyunsaturated fatty acid that influences:
 - Membrane structure and function
 - Cell signalling and communication mechanisms
 - Gene expression
 - Lipid mediator production

Nucleotides



- Non protein amino acids found abundantly in breast milk
- Breastfed infants ingest 1.4-2.1 mg of nucleotide nitrogen per day
- Unknown whether immunomodulating effects are translated into clinical benefits in well nourished infants



Lutein



- A carotenoid thought to play a role in vision and eye health.
- Much higher concentration in breast milk
- Evidence is inconclusive

Prebiotics



- Food for the GIT and gut flora
- Stimulate the growth of probiotics
- Alter the composition of the gut flora (microbiome) *Agostoni et al, 2004*
- Found naturally in breast milk
- Oligosaccharides (GOS + FOS)
- Recently permitted in infant formula
- Limited evidence

Probiotics



- Live organisms which have proven benefits by adding beneficial bacteria to the GIT
- Bifidobacteria, lactobacillus
- Associated with immunity and increased absorption of nutrients



Benefits of Probiotics



- **Protection from NEC in preterm infants**
 - Cochrane review 2014
- **Treatment of antibiotic and non-antibiotic associated rotavirus illness in infants**
- **Evidence for a possible link to reduction in colic symptoms in babies**

Floch *et al*, 2008 & Alfaleh *et al*

Probiotics in Infant formula



- More commonly added to infant formulas
- Bifidobacterium and lactobacillus
- Controversial with regards to preparation of formula
- Two Cochrane reviews and a review by ESPGHAN concluded there was

"insufficient evidence to support their use"



Questions?