

Infant formula

Key Reviewer: **Barbara Cormack**, Paediatric Dietitian, Auckland City Hospital

While it is recognised that breastfeeding is the best option for mother and baby, some mothers cannot or choose not to breastfeed. General practitioners, practice nurses and other health professionals should have knowledge of infant formula so they can provide guidance for these mothers.

Exclusive breastfeeding for around six months is ideal, at which time complementary foods can be introduced with continued breastfeeding until the infant is aged at least one year.¹ All efforts should be made to encourage breastfeeding for as long as possible.

Key concepts

- Breastfeeding is best
- Cows' milk based formula is recommended if breastfeeding does not occur
- Soy formula is rarely indicated and is not recommended for cows' milk allergy
- Hydrolysed cows' milk formula can be used for infants with cows' milk allergy

Important considerations when infant formula is used:¹

- Encourage the maintenance of breastfeeding if possible
- Choose an appropriate formula for the infant's age
- Cows' milk-based formula is routinely recommended for feeding an infant who is not breastfed
- Soy based infant formula should not be used routinely
- At six months of age, if an infant is thriving on regular or standard infant formula and complementary foods, there is generally no advantage to changing to a follow-on formula
- Formula should be made up as close as possible to feeding time and needs to be handled and stored carefully

How does breast milk differ from formula milk?

Breast milk is a complex nutritional food that contains antibodies, enzymes and hormones, all of which have significant health benefits. While the composition of formula milk is modelled on breast milk it cannot replicate it exactly.²

Breast is best

Breast milk is the preferred food for all infants. It is a nutritionally complete food and is all that is required for a baby's first six months of life. It has many beneficial effects for both mother and infant. See Table 1 for examples.

There are very few reasons not to breastfeed

There are only a few situations where breastfeeding is contraindicated such as infants with galactosemia, mothers receiving chemotherapy or mothers with HIV or uncontrolled tuberculosis.

Prescribing for breastfeeding mothers²

Maternal drug therapy should rarely constitute a reason to avoid breastfeeding.

Caution should be used with the following drugs and the infant monitored:

Antiepileptics	Lithium	Sedatives
Antipsychotics	Diuretics	Codeine*

*The amount of codeine present in breast milk is usually too small to be harmful however mothers vary considerably in their capacity to metabolise codeine. One case of fatal morphine toxicity has been reported.



Monitor the infant for evidence of adverse effects e.g. sedation, altered bowel habit.

Useful reference sources:

Ministry of Health:

www.moh.govt.nz/breastfeeding

UK Drugs in Lactation Advisory Service:

www.ukmicentral.nhs.uk/drugpreg/guide.htm

Drugs and Lactation Database (LactMed):

<http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?LACT>

In New Zealand, the rates of breastfeeding do not reflect the vital role breastfeeding plays in an infant's development. Overall only 66% of infants are breastfed at six weeks and this decreases to only 25% by six months.¹

Table 1: Beneficial effects of breast feeding for mother and infant^{1,2}

Beneficial effects for infant	Beneficial effects for mother
Provides optimum nutrition	Encourages contraction of the uterus after birth
Reduced incidence and severity of infectious disease (e.g. gastrointestinal or respiratory infection, otitis media)	May reduce the risk of ovarian and breast cancer
Associated with decreased risk of chronic disease later in life (e.g. high blood pressure, obesity, diabetes)	May help the mother return to her pre-pregnancy weight
Assists with physical and emotional development	May reduce risk of other conditions (e.g. type 2 diabetes, postnatal depression, osteoporosis)

Breastfeeding rates and use of infant formula among Māori¹

In 2006*, the rate of exclusive breastfeeding for Māori infants at six weeks of age was 59% compared with 66% of infants across all ethnic groups (70% for European infants, 55% for Asian infants and 57% for Pacific infants).

Information from 2005* shows that the rates of infant formula use was highest for Māori infants across all age groups (25% at six weeks, 37% at three months and 49% at six months).

“Whanau have the biggest influence on whether a mother breastfeeds or not, and provide the best support for the breastfeeding mother. The best way to improving breastfeeding statistics is through whanau, hapu and iwi development.”

— **Raeleen de Joux**, Maori Educator, New Zealand Breastfeeding Authority. Te Karaka 2008, Issue 39.

*Rates from Plunket representing approximately 90% of all births

Infant feeding definitions

Infant formula – Formula intended as a substitute to breast milk for infants from birth to six months old.

Follow-on formula – Formula that is marketed for infants aged from six months to 12 months.

Complementary feeding – Foods fed to infants from around six months to complement breastfeeding or formula feeding.

Types of formula

In New Zealand, infant formula and follow-on formula must comply with the requirements of the Australia New Zealand Food Standards Code.³ This code contains standards for the composition of infant formulas so they meet the nutritional needs of a growing infant.

Infant formulas differ depending on where the protein in the formula is derived. Infant formulas available in New Zealand are based on cows' milk, goats' milk and soy protein.

Cows' milk-based formula is routinely recommended for feeding an infant who is not breastfed

Cows' milk-based formula is recommended as the first choice for feeding healthy infants who are not fully breastfed.⁴

The protein in cows' milk-based formula is derived from cows' milk. The carbohydrate component is generally provided by lactose, corn syrup solids and corn maltodextrin. Vegetable oil blends usually provide the fat component.

Whey and casein are the two types of protein present in breast milk and cows' milk. Breast milk contains more whey than casein and this ratio changes over the course of lactation.¹ Infant formulas vary in their composition and may be whey or casein dominant.

There are many different commercially available cows' milk based formulas which are readily available from supermarkets and pharmacies. Some examples are S-26, Nurture Starter, Novalac 1, Nan 1 Gold Protect and Karicare Gold 1. Cows' milk formulas appropriate for infants aged up to six months often have “1” or “starter” in their name.

Regular cows' milk is not suitable for infants aged less than one year

Soy-based formula should not be used routinely

There are only a few indications for the use of soy-based infant formula in place of cows' milk-based formula. These indications are: infants with galactosaemia, a rare inherited condition where infants are unable to metabolise galactose to glucose, or vegan infants who are not breastfed.

The protein in soy-based infant formula is derived from refined soy protein isolate. Soy-based formula is free of lactose and cows' milk protein.¹ However soy-based formula is not recommended for cows' milk allergy as 10-14% of infants with allergy to cows' milk protein will also have a soy protein allergy (see hydrolysed formula for recommendations).^{2,4}

Soy-based formula is not designed for or recommended for pre-term infants.¹⁴

Soy-based formula needs to meet defined standards for infant formula and requires fortification with the amino acid methionine. Soy-based formulas contain high concentrations of phytate, aluminium and phytoestrogens, for which the long term effects are unknown.⁴ Examples of soy-based formula are S-26 Soy and Karicare Soya.

Goats' milk-based formula

Goats' milk formula is not suitable for infants with lactose intolerance, galactosaemia or allergy to cows' milk protein.¹ It contains lactose and has cross-reactivity with cows' milk protein, which means that infants allergic to cows' milk are also likely to be allergic to goats' milk. The likelihood of cross-reactivity between cow and goat milk is approximately 90%.⁵

Specialised formula and additional ingredients

Hydrolysed formula for cows' milk protein allergy

Partially or extensively hydrolysed formula contains cows' milk protein that has been broken down into peptides. In general, the more extensive the hydrolysis of the protein, the less likely it is to cause an allergic response.¹ Extensively hydrolysed formula (e.g. Pepti Junior) should be used for the treatment of children who have diagnosed cows' milk

allergy.⁶ If allergic symptoms persist a free amino acid formula (e.g. Neocate) is recommended.^{4,7}

There is some evidence for the use of hydrolysed formula for high risk infants (infants with at least one first-degree relative – parent or sibling – with diagnosed allergic disease) to prevent or delay the development of atopic dermatitis. Extensively hydrolysed formula may be more effective in preventing allergies than partially hydrolysed formula.^{1,7} The recently published German Infant Nutritional Intervention study confirms a preventive effect of hydrolysed infant formula persists until age six years.⁸ More research is needed into whether these benefits extend into late childhood and beyond.

Hydrolysed formula carries a significant cost and referral to a paediatrician or allergy specialist is advised to obtain funding for them under special authority.

Probiotics, prebiotics and long chain polyunsaturated fatty acids

Probiotics, prebiotics and long chain polyunsaturated fatty acids are added to infant formula to make them more closely resemble breast milk.

Probiotics are live bacteria that colonise the gastrointestinal tract. When administered in adequate amounts they may improve gut barrier function and host immune response. There are many different strains of probiotics but the most common are *Bifidobacterium* or *Lactobacillus* species. Breastfed infants have been shown to have more Lactobacilli and Bifidobacteria in their intestines than formula fed infants.

Prebiotics are food ingredients (usually oligosaccharides) that are resistant to digestion in the small intestine. They are fermented by beneficial bacteria in the large intestine selectively stimulating the growth of non-pathogenic bacteria in the colon such as *Lactobacilli* and *Bifidobacteria*. Breast milk contains oligosaccharides which have been shown to demonstrate a prebiotic effect in infants.⁹

Two systematic reviews in 2007 found that there was insufficient evidence to recommend the use of probiotics or prebiotics in infant formula for the prevention of allergic disease or food reactions.^{10 11}

Long chain polyunsaturated fatty acids (LCPUFAs) are present in breast milk. LCPUFAs are important components of the phospholipids present in the retina and the brain and are also integral structural components of all cells in the body. Almost half the high lipid content of the brain is LCPUFAs. Since the mid 1990s LCPUFAs, have been the focus of much research. Early research suggested that infants fed a continuous supply of LCPUFAs, from either breast milk or a supplemented formula, may have improved visual functioning.¹² For this reason LCPUFAs are now added to some infant formula. Although LCPUFA-supplemented infant formula seems safe, a 2007 Cochrane Systematic Review found that the results of most of the well conducted randomised controlled trials, have not shown beneficial effects of LCPUFA supplementation on the physical, visual and neurodevelopmental outcomes of infants born at term.¹³

Indications for switching formula

Generally there is limited evidence for switching formula when infants experience symptoms such as vomiting, spilling, crying, diarrhoea or constipation.

- Lactose intolerance – lactose-free (e.g. De-lact, S-26 LF) and reduced lactose cows' milk formula (e.g. Novalac AC or AD) can be used when the elimination or reduction of lactose from the diet is required. However lactose intolerance is likely to be dose dependent and only rarely does lactose need to be totally eliminated from the diet. Therefore the use of lactose-free soy-based formula for this indication should be restricted.¹⁴
- Diagnosed cows' milk protein allergy – An extensively hydrolysed protein formula (see previous page) should be used for infants with

cows' milk protein allergy. Soy-based formula is not recommended in infants with allergy to cows' milk protein.¹⁴

- Acute gastroenteritis – most previously well infants can be managed after initial rehydration with continued use of breast milk or standard cows' milk formula.
- Colic, regurgitation or prolonged crying – Counselling parents about the cause and duration of colic may have more value than switching formula. There is no evidence for soy-based formula for the prevention or management of infantile colic, regurgitation or prolonged crying.⁴
- Prevention of allergies – There is some evidence for using hydrolysed formula for preventing allergies.⁸ Routine use of soy-based formula has no proven value in the prevention of atopic disease in healthy or high-risk infants.

Follow-on formula

Follow-on formula is designed for infants from 6–12 months. It is fortified with additional nutrients such as iron. However if an infant is thriving on the standard infant formula and eating a well-balanced complementary diet, switching to this formula is not usually necessary.²

Regular cows' milk is not suitable for infants aged less than one year. For infants weaned from breastfeeding after they are six months old and before 12 months old a follow-on formula may be an appropriate choice.

When to refer to a paediatrician

- If special authority for prescription is required
- If the infant is failing to thrive
- If you suspect a serious adverse reaction to a formula
- If you are unsure of the diagnosis

References:

1. Ministry of Health. Food and nutrition guidelines for healthy infants and toddlers (Aged 0-2): A background paper. 4th Ed. Wellington: Ministry of Health; 2008.
2. Hoddinott P, Tappin D, Wright C. Breast feeding. *BMJ* 2008; 336:881-887.
3. Food Standards Australia New Zealand. Available from: <http://www.nzfsa.govt.nz/> (Accessed: July 08)
4. Agostoni C, Axelsson I, Goulet O, et al. Soy protein infant formulae and follow-on formulae: A commentary by the ESPGHAN committee on nutrition. *J Pediatr Gastroenterol Nutr*; 42(4): 352-361.
5. Sampson H. Food allergy. Part 2: Diagnosis and management. *J Allergy Clin Immunol* 1999; 103:981-9.
6. British National Formulary for children. BMJ Publishing Group and Royal Pharmaceutical Society of Great Britain. 2008.
7. Greer FR, Sicherer SH, Burks AW, et al. Effects of early nutritional interventions on the development of atopic disease in infants and children: The role of maternal dietary restriction, breastfeeding, timing of interdictio of complementary foods, and hydrolysed formulas. *Pediatrics* 2008; 121: 183-191.
8. Von Berg A, Filipiak-Pittroff B, Kraemer U et al. Preventive effect of hydrolyzed infant formulas persists until age 6 years: Long-term results from the German Infant Nutritional Intervention Study (GINI). *J Allergy Clin Immunol* 2008; 121:1442-7.
9. Ward RE, Ninonuevo M, Mills DA, et al. In vitro fermentation of breastmilk oligosaccharides by *Bifidobacterium infantis* and *Lactobacillus gasserii*. *Appl Environ Microbiol* 2006; 72: 4497-9.
10. Osborn DA, Sinn JK. Prebiotics in infants for prevention of allergic disease and food hypersensitivity. *Cochrane Database of Systematic Reviews* 2007; 4.
11. Osborn DA, Sinn JK. Probiotics in infants for prevention of allergic disease and food hypersensitivity. *Cochrane Database of Systematic Reviews* 2007; 4.
12. Makrides M, Neumann M, Simmer K, et al. Are long-chain polyunsaturated fatty acids essential nutrients in infancy? *Lancet* 1995; 345: 1463-8.
13. Simmer K, Patole SK, Rao SC. Longchain polyunsaturated fatty acid supplementation in infants born at term. *Cochrane Database of Systematic Reviews* 2007; 3.
14. Bhatia J, Greer F, et al. Use of soy protein-based formulas in infant feeding. *Pediatrics* 2008; 121: 1062-1068.

