

SPECIAL NEEDS INFANT FORMULAS

Infant formulas have become extremely diverse since their original inception - and now come in many different forms. These range from those for healthy-term infants with ingredients designed to mimic the compositional and functional outcomes of breast milk, to those for a multitude of conditions from lactose intolerance to prematurity, from malabsorption to inborn errors of metabolism.



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NICHE FORMULAS

Formulas have been produced to help with minor digestive problems in infancy. The main two categories are:

1. Anti-regurgitation formulas - these thicken in the stomach and so may be useful for some babies who have troublesome vomiting - but are otherwise well. An alternative to this is to add a thickening agent to the milk - however options are limited for infants and rely on the parent or carer being given appropriate advice on how to use the thickening agent.
2. 'Comfort' formulas - these are marketed for colic and constipation and again may have a place for babies who have gastrointestinal symptoms that are troubling their parents, but do not require medical intervention. These formulas have a few modifications that are said to help; they contain partially hydrolysed

protein, are lower in lactose, thicker and contain prebiotics.

PRETERM FORMULAS

The third trimester of pregnancy represents the most rapid period of growth in the life cycle. If infants are born preterm, they therefore have nutritional requirements that are higher than a term infant, even before considering the extra requirements of breathing, temperature regulation, possible infection (caused by immature immunity) etc, that a foetus would not encounter (see requirements in Table 1).

1. Breast milk fortifier - expressed breast milk from an infant's own mother is the most suitable milk for a preterm infant. It is known to reduce the risk of necrotising enterocolitis (NEC), a life threatening complication of prematurity leading to inflammation, necrosis and even

Table 1: Nutritional Requirements of preterm infants (1)

	Energy Kcals/kg/d	Protein g/kg/d	Vitamin A ug	Vitamin D IU	Iron mg	Calcium Mmols	Phosphate Mmols
Term infants (0-3 months)	100	2.1	350 Per day	340	1.7 Per day	13.1 Per day	13.1 Per day
Preterm infants	110 – 135	4.0 – 4.5 (<1.0kg) 3.5 – 4.0 (1.0-1.8kg)	400 – 1000 /kg/d	800 – 1000 Per day	2-3 /kg/d	3.0 – 3.5 /kg/d	1.9 – 2.9 /kg/d

perforation of the gut. It also has benefits including anti-inflammatory components (IL-10), growth factors (EGF), erythropoietin, lysozymes and immunoglobulins, as well as pre and probiotics which favourably affect gut microflora. However, particularly for infants <1.0kg, after the first two to three weeks, breast milk alone is unlikely to meet the infant's requirements, particularly for protein, even if given in high volumes. Therefore, breast milk fortifier, a powdered product in sachets, can be used, which increases the calorie, protein and vitamin content of the milk, while allowing the full volume of breast milk to be given.

2. Preterm formulas - for infants whose mothers cannot or choose not to provide breast milk, they need formulas that will meet these extra requirements. Preterm formulas are designed to meet these higher requirements, typically containing 80kcal/100mls and 2.6g protein/100mls (compared with 67kcal/100mls and 1.3g protein/100mls in a term formula), as well as higher amounts of vitamins and minerals to meet their additional requirements.
3. Post-discharge formulas - even once discharged, nutritional requirements may be higher than for a term infant of the same post-conceptual age. Therefore, post-discharge formulas have been produced, which are half way between preterm and term formulas in composition - to help meet the ex-preterm infant's requirements for energy, protein, vitamins and minerals and to allow catch up growth.

FOOD HYPERSENSITIVITY

Food hypersensitivity is the term that has been recommended by the World Allergy Organisation (3) to refer to all reactions to food that are not psychologically based. This encompasses non-allergic food hypersensitivity (which in-

cludes lactose intolerance and coeliac disease) and food allergy: IgE mediated and non-IgE mediated (the new term for what used to be called food intolerance).

NICE (5) have recently published guidance for the diagnosis and assessment of allergy in children and young people in primary and community settings to aid community practitioners (primarily GPs) in the assessment, diagnosis and care of children and young people with allergic reactions. A key confusion among GPs and health visitors alike is the difference between lactose intolerance and cows' milk allergy in infants.

- Lactose intolerance is the inability to digest lactose (milk sugar), due to the relative or absolute absence of the enzyme lactase.
- Cows' milk allergy is caused by an allergic response to one of more of the milk proteins.

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TREATMENT OF

LACTOSE INTOLERANCE

Lactose intolerance may be temporary or permanent and may be caused by:

- primary alactasia - a rare condition characterised by profuse watery diarrhoea from birth;
- primary lactase deficiency - which causes progressive lactose intolerance through childhood. This varies between ethnic groups, being rare in Northern Europeans, to almost endemic in some Asian and African populations;
- secondary lactase deficiency - the most commonly seen in practice. Typical history is of a bout of gastroenteritis in an infant causing diarrhoea, which recurs whenever milk is regraded into the diet. This is caused by damage to the villi by the infection. Since the lactase enzyme sits at the end of gut villi, it is very vulnerable to damage. Treatment is six to 12 weeks of a lactose free formula (and diet if the infant is weaned) after which time the baby can usually be regraded back onto a normal formula. ▶

Table 2: Signs and symptoms of possible food allergy (4)

Taken from page 6 of NICE guideline No.116: Food allergy in children and young people: Diagnosis and assessment of food allergy in children and young people in primary care and community settings.

IgE mediated	Non IgE mediated
Pruritus	Pruritus
Erythema	Erythema
Acute urticaria	Atopic eczema
Angioedema	Gastro-oesophageal disease
Nausea	Loose or frequent stools
Colicky abdominal pain	Blood and/or mucous in stools
Vomiting	Abdominal pain
Diarrhoea	Infantile colic
Upper respiratory tract symptoms (nasal itching, sneezing, rhinorrhoea or congestion [with or without conjunctivitis])	Food refusal/aversion
Lower respiratory symptoms (cough, chest tightness, wheezing, shortness of breath)	Constipation
Signs or symptoms of anaphylaxis or other systemic allergic reactions	Perianal redness
	Pallor and tiredness
	Faltering growth (in conjunction with at least one or more GI symptom above (with or without atopic eczema)

Historically, lactose intolerance was treated with a soya infant formula (these are not now generally recommended - see later), but lactose-free formulas are now available. These contain cows' milk protein and all the other usual ingredients of a normal infant formula, except the lactose is replaced by another carbohydrate. Since some community health professionals do not understand the difference between lactose intolerance and cows' milk allergy, nor the differences between different formulas, there is a risk that an unnecessarily specialist formula, which is not needed (and is more expensive) will be used.

COWS' MILK ALLERGY

The symptoms of cows' milk allergy are many and diverse (see Table 2 taken from NICE 2011: 5). NICE (5) have issued guidance for the assessment and diagnosis of allergy in children and young people for primary care. IgE mediated allergy is easier to diagnose, as symptoms occur at the time, or shortly after, ingestion. However, non-IgE mediated allergy may be more difficult to identify as symptoms take longer to appear, making identifying a trigger(s) possibly more problematic. For eczema resistant to compre-

hensive topical treatment, a trial of a milk-free formula is recommended (4) and for other symptoms such as severe colic or frequent type 7 stools, a trial of a milk-free formula may be indicated. Choices of alternative protein source for formulas are as follows:

1. Soya - this has not been advised for almost 10 years (2, 6) - particularly in infants under six months - because of the theoretical risks to future fertility (particularly in boys), but also because of the significant risks of cross reactivity with cows' milk protein, particularly for non-IgE mediated cows' milk allergy.
2. Extensively hydrolysed protein - this can be based on whey or casein protein. Whey hydrolysates are said to be more palatable, however, casein hydrolysates have smaller protein fragments and are therefore said to be less allergenic. Versions of these formulas are also available with a proportion of the fat as medium chain triglycerides (MCT), making them also suitable for infants with malabsorption syndromes.
3. Amino acid mixes - one brand is made in a totally milk-free environment, making it the gold standard for diagnosis of cows' milk allergy. ▶

FALTERING GROWTH

Historically, when infants had episodes of faltering growth (or failed to thrive as it was then known), usual practice was either to concentrate a standard formula (i.e. more powder in less water), or to add carbohydrate and/or fat to the feed.

However, in recent years, the importance of protein for adequate catch-up growth has become better recognised; at least nine percent energy from protein is needed to allow accelerated or catch-up growth to occur. Nutrient dense formulas have therefore been developed, containing 90 to 100kcal/100mls and 2.0 to 2.6g protein/100mls, as well as higher levels of vitamins and minerals.

SPECIALIST FEEDS

There are many feeds that are produced for specific conditions. These include:

1. metabolic feeds - these are produced for a variety of inborn errors of metabolism, modifying (particularly) the amino acid profile depending on the particular needs of the condition;
2. feeds for malabsorption - these have partly already been mentioned - feeds are available with different types and degrees of hydrolysed protein, different percentages of MCT and different carbohydrates, depending on the indications for use;
3. modular feeds - in some cases a modular feed will be constructed when there is no suitable proprietary feed available - this allows the use of separate protein, carbohydrate, fat, electrolyte, vitamin and mineral modules depending on the need of the infant.

References

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- 6 Paediatric Group of the British Dietetic Association Position Statement (2010). Use of infant formulas based on soy protein for infants. www.bda.uk.com/publications/PaediatricGroupGuidelineSoyInfantFormulas.pdf
- 7 Simmer K, Patole SK, Rao SC (2011). Longchain polyunsaturated supplementation in infants born at term. *Cochrane Neonatal Group*. Accessed 15/5/2012 DOI: 10.1002/14651858.CD000376.pub3



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Questions relating to: *Special needs infant formulas*

Type your answers below and then **print for your records** or print and complete answers by hand.

Q.1 Describe the two main categories of infant formulas designed for minor digestive problems.

A

Q.2 What are the nutritional requirements for preterm infants?

A

Q.3 Describe the benefits of breast milk.

A

Q.4 Explain why breast milk needs to be fortified for a preterm infant.

A

Q.5 What are preterm formulas designed for and what nutritional benefits do they provide?

A

Q.6 State at least six signs and symptoms for each of IgE and Non IgE mediated food hypersensitivity.

A

Q.7 Describe the difference between lactose intolerance and cows' milk allergy.

A

Q.8 Describe the criteria of temporary and permanent lactose intolerance.

A

Q.9 Explain the rationale of the importance of providing adequate for infants with faltering growth.

A

Q.10 Explain the nutritional requirements of protein, energy, vitamin A and D, iron and calcium for a preterm infant weighing 1.8kg.

A

Please type additional notes here . . .