

Understanding infant formula

Donna Traves

Abstract

The World Health Organization recommends breast feeding infants for the first six months of life. When this breast feeding does not occur either through parental choice or medical need, infant formulas will be required. There is a bewildering array of formulas on the UK market for many different requirements. When faced with an unsettled infant many parents (and health care professionals) will experiment with the infant formula available and then attend the paediatric clinic looking for help and advice. It is therefore essential that paediatricians understand what milks are available and what the key differences between different products are. This review attempts to provide a simple guide through many of the formulations currently available in the UK; and offers advice for the dietary management of the child with extra calorie requirements, infants with cow's milk protein allergy, gastro oesophageal reflux disease, apparent unresolved hunger and infantile colic. Whatever the underlying condition, there is likely to be an infant formula that is suitable in this generation of ever expanding formulations.

Keywords allergy; casein; colic; elemental; energy; feeding; formula; hydrolysed; infant; milk; preterm; reflux; soya; specialised; whey

Background

The World Health Organization (WHO) recommends that infants be exclusively breastfed for the first six months of life to achieve optimal growth, development and health. Mothers should continue to breastfeed their children beyond the age of six months, until they are two years of age or older, at the same time providing them with safe and appropriate complementary foods to meet their evolving nutritional requirements. When this breast feeding does not occur either through parental choice or medical need, infant formulas will be required. With ever increasing varieties of infant formula on the market, trying to understand which formula is right for which baby is getting increasingly complex. There are now formulas available for almost every type of problem and trying to choose a formula that is appropriate and then have to explain the differences to parents can be daunting (Figure 1).

Infant formula basics

Before looking at some case studies, it is first useful to understand the basics of infant formulas and milk products. Every infant formula will contain four basic things; carbohydrates, proteins, fats, vitamins and minerals. Alongside these, many brands will put in additional substances such as prebiotics to aid digestion and nucleotides e.g. docosahexaenoic acid (DHA) and arachidonic acid (ARA). These nucleotides are also found in breast milk and promote brain and eye development.

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Milk is comprised mainly of two main proteins: casein and whey. Casein is a less soluble protein so tends to stay longer in the stomach, whereas whey proteins are more soluble thereby pass through the stomach quicker. Unmodified cow's milk has a whey:casein ratio of approximately 20:80. This is quite different to the whey:casein ratio seen in human breast milk. The proteins in human breast milk vary with the stage of lactation, with a whey:casein ratio of about 90:10 in the first few days of lactation, about 60:40 after the first few days with the ratios becoming equal at 50:50 after 12 months. In 'first' formula milks, often labelled 'stage 1', the whey:casein ratio has been adjusted by the addition of whey protein concentrate, to be more in line with the balance of proteins in human breast milk; with a whey:casein ratio of 60:40 being found in most standard infant formulas e.g. Cow and Gate first, SMA first and Aptamil First.

Case 1

Amelie is 4-month-old. She has always been a "hungry baby". As she is 8 kg her requirements at 150 ml/kg/day would be 1200 ml (200 ml 4 hourly). Amelie frequently takes 300 ml per feed and parents are asking which hungry baby feed they should change her to. What do you discuss with them and suggest?

Hungry baby formulas

The formulas that are made for the hungrier babies are casein based and usually have whey:casein ratio of 20:80. This is very different from the standard formulas noted above. These formulas are often known or marketed as the stage 2 formulas although they can be used from birth. The theory is that the higher casein content helps to slow digestion and so results in the baby feeling more satisfied and less hungry soon after feeding. The evidence for this is limited and there is often no clinical reason why babies need to swap to these formulas, as they are not higher in calories, protein or micronutrients. Despite this lack of concrete evidence many parents choose these hungry baby formulas with a relatively successful outcome.

Case 2

Sam is 12-month-old. He is a healthy boy with no significant past medical history he is thriving and has been weaned successfully onto a normal "toddler diet". Sam continues to have a bottle of standard formula in the morning and evening. His anxious parents ask your advice regarding follow on milks and whether he should have one now that he is aged one.

Follow on formulas

Most children will swap from infant formula to pasteurised (full fat) cow's milk around the age of one and this is the usual, standard advice, assuming they have weaned to a reasonable toddler diet. There is no reason for most infants and young children to need a follow on formula milk. Follow on formulas are sometimes known or marketed as stage 3 formulas. These formulas are designed to be used from 6 months of age onwards, although more commonly they are used from 12 months and are designed to be more like cow's milk than breast milk, as they are casein based. There may be a place for using follow on



Figure 1 A selection of infant formulas available – which one do you choose?

formulas in those who are struggling to wean their young children as these formulas have higher levels of iron, calcium, zinc and vitamins A & C than standard formulas - although these are in a less bio-available form than in many foods. Follow on formulas also often contain pre and pro-biotics, which is a strong selling point for some parents. The evidence for added value of these products in otherwise healthy children is lacking.

Case 3

Lucy is a 3-month-old baby who has always been difficult to feed. She was breastfed for 2 weeks after which time she has been bottle fed. She developed severe eczema at 4 weeks. Lucy arches her back after feeds, cries all the time and vomits after every feed and in between feeds. Lucy has been given infant gaviscon and ranitidine and her parents have tried positioning her in a variety of ways during and after feeds. None of this has made any difference to the vomiting. The possibility of cow's milk protein allergy has been raised and you want to start her on a cow's milk protein formula. Lucy has negative skin prick tests and specific IgE to cow's milk. Which formula do you choose to start?

Hydrolysate formulas

There are now many formulae available for cow's milk protein allergy (CMPA). The previous term cow's milk protein intolerance has now been largely replaced by CMPA, which in turn is then divided into IgE Mediated and non-IgE mediated subtypes. The choice of formula is likely to vary depending on the type of CMPA diagnosed. In Lucy's case the presence of typical CMPA symptoms in the presence of negative skin prick and sIgE tests suggest non-IgE mediated CMPA. The formulas used in CMPA can broadly be divided into those that extensively hydrolysed (peptide-based) and those that are amino acid based. Formulae that have been extensively hydrolysed are peptide-based feeds containing hydrolysates of casein or whey. They have been heated and treated to break down nearly all of the cow's milk protein present. It important to note that small amounts of unhydrolysed cow's milk protein may still be present. There are

several different types of extensively hydrolysed formula available and these have important differences.

In children with CMPA different extensively hydrolysed formula may have differing efficacy in an individual child. Thus infants who are reacting predominantly whey proteins might respond better to a casein based formula and those who are reacting to predominantly casein proteins might find a whey based formula more effective (see Table 1). For those with non-IgE mediated CMPA either of these formulas will usually suffice and be well tolerated with resolution of symptoms within 4 weeks.

There are many subtler differences that the companies marketing these formulas will promote. For example Nutramigen contains nucleotides that promote eye development. Aptamil pepti is generally taken to be more palatable so for those older babies who are developing more distinctive tastes they may take to this better – this is predominantly due to it being whey based, as whey is more palatable. Pregestimil is also casein based but it has added medium chain fatty acids and 55% of its fat is MCT (Multitriglyceride), which helps with any malabsorption issues.

For those babies who have improved but still remain symptomatic on an extensively hydrolysed formula and where the diagnosis is quite certain, switching to an amino acid based formula may be an option. See case 4 below for more guidance on these formulas.

Soya-based infant formula

Soya-based infant formulas were originally developed for babies who had CMPA and for a long time were the main or only option. The hydrolysed and amino acid based formulas that are now available are usually more suitable and are now first line treatments; not least because a significant proportion of children with CMPA will also react to soya protein. There are occasional indications for a baby having a soya formula, for example infants that can't or won't drink the hydrolysed formula, or non breastfed infants with CMPA whose parents want their baby to have a vegan diet.

Soya formulas currently available in the UK include Infasoy and Wysoy. It is not advised for babies under 6 months and ideally should not be used until after 1 year. In babies with CMPA who can tolerate soya, most will be advised to change from the extensively hydrolysed formula to soya milk after the age of one year. Normal soya milk is suitable as a main milk source and the use of formula is not generally needed.

There are some theoretical concerns over soya milks as they contain phytoestrogens, these compounds are found naturally in some plants including soy. As their name suggests, the chemical structure of phytoestrogens is similar to the female sex hormone oestrogen. There have been concerns that these increased levels could interfere with male hormones, leading to delayed or weakened sexual development in males that can then compromise fertility. Many reviews of the evidence have however, shown that there is no conclusive evidence to support the theory that dietary soy phytoestrogens adversely affect human development, reproduction, or endocrine function. The general advice remains, however, not to give soya milk under 6 months and is not generally recommended until 1 year.

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