Abstract

The mother of a pediatric patient was recently diagnosed with a rheumatologic illness, requiring her to take medications that would be dangerous to her nursing baby. She realized that she would need to feed her baby formula. She asked me, “What is the difference between the formulas at the grocery store? Which is the best kind for my baby?” The answer to this question is different for every baby. This article is a short guide for primary care pediatricians to help them understand the differences between common formulas. [Pediatr Ann. 2015;44(2):51-54.]

According to the US Food and Drug Administration, “an estimated 1 million infants in the United States are fed formula from birth, and by the time they are three months old, about 2.7 million rely on formula for at least part of their nutrition” (Figure 1). There is a certain amount of confusion when it comes to infant formulas—for patients and providers alike. This article explores the differences between common infant formulas, and how to help families find the best alternative to breast milk. This discussion will be a mixture of personal anecdote and professional opinion. It is also worth saying that breast milk is the ideal nutrition source for the vast majority of all babies.

FULL-TERM INFANT FORMULAS

In formulas for full-term infants, there are differences based on protein, fat, and carbohydrate sources. Proteins can be intact (usually cow’s milk protein or soy protein), hydrolyzed, or synthetic amino acids. Fat sources are usually vegetable-based oils, medium-chain triglyceride oils, essential fatty acids, and long-chain polyunsaturated fatty acids such as arachidonic acid (ARA) and docosahexaenoic acid (DHA). ARA and DHA are thought to be important for infant brain and eye development. Carbohydrate sources are usually lactose, sucrose, or glucose.

There are important micronutrients in most full-term infant formulas, including iron and vitamin D. Iron is recommended by the American Academy of Pediatrics (AAP) to help prevent iron-deficiency anemia, but beware
that some infant formulas have low iron content (such as Similac® Lower Iron [Abbott Laboratories, LTD, Saint Laurent, Quebec, Canada]). Vitamin D is also recommended by the AAP, at a dose of 400 IU per day.2 Many formulas require a daily intake of 27-28 ounces to meet the daily requirement of vitamin D, but many formula-fed babies do not reach this volume every day. Therefore, many formula-fed babies need vitamin D supplementation. It is also recommended that breast-fed babies, too, are supplemented with vitamin D.

Milk protein-based formulas are, by far, the most common formulas. Examples include: Enfamil® Infant (Mead Johnson & Co., Glenview, IL), Similac® Advance® (Abbott, Columbus, OH), and Earth’s Best Organic® Infant Formula (Hain Celestial Group, Boulder, CO).

There are also many milk protein-based formulas that are marketed toward parents of “fussy,” “colicky,” “spitty,” or “gassy” babies. These formulas claim to reduce these symptoms, but unfortunately few studies exist to verify this claim. These formulas include Enfamil® Gentlease (Mead Johnson & Co., Glenview, IL), Gerber® Good Start® Gentle (Nestle, Florham Park, NJ), Similac® Sensitive® (Abbott, Columbus, OH), Earth’s Best Organic® Sensitivity Infant Formula (Hain Celestial Group, Boulder, CO), and Enfamil Acid Reflux® (Mead Johnson & Co., Glenview, IL). These formulas differ based on their protein source, whey:casein ratio, amount of hydrolyzed protein, and carbohydrate source. Many of these types of formulas contain proteins that are hydrolyzed, with molecular weights <2,000 Da. The basic premise is that partially hydrolyzed proteins will be “easier” for the baby to digest. There are some studies that also demonstrate that hydrolyzed proteins may be better in preventing allergies and eczema in high-risk infants who are unable to breast-feed.3,4 However, many of these formulas still contain proteins that are closer in molecular weight to whole-milk protein (>10,000 Da), which is why they can be classified as “partially hydrolyzed” formulas.

Very few independent studies exist to substantiate that these formulas are “easier to digest.” One study looked at stool characteristics between babies who are fed breast milk, milk protein formula, milk protein formula low in iron, and extensively hydrolyzed milk protein formula.5 They found differences in the number of stools, the color of stools, and the hard versus soft stools between the groups, but they found no difference in spitting, gassiness, or crying among the four groups.5 Clearly, there needs to be more research on the effects of hydrolyzed protein formulas on these symptoms. These partially hydrolyzed formulas are often more expensive compared to the “regular” formulas, and the jury is still out on whether or not they make any difference.

Soy protein formulas (such as Gerber® Good Start® Soy [Nestle, Florham Park, NJ] and Similac® Soy Isomil® [Abbott, Columbus, OH]) are often marketed toward parents with concerns of a milk protein allergy in their babies. However, it’s important to remember that many babies with a milk protein allergy will also have a soy protein allergy because of similarities in the protein structure. Additionally, many soy-based formulas contain little to no lactose, and so they are also marketed toward parents with concerns for lactose intolerance in their babies. In general, it is rare for babies to have true lactose intolerance, although it does happen in older children and adults. Some babies may have lactose intolerance after bounts of diarrhea. However, this is usually a transient problem and does not require changing formulas. Some rare diseases such as galactosemia will require a baby to be on lactose-free formula, but the vast majority of babies are able to digest lactose easily.

**PRETERM INFANT FORMULAS**

Many premature infants are given enriched formula with higher calories per ounce when they are sent home from the neonatal intensive care unit. Standard infant formula is approximately 19-20 kcal/oz, whereas these formulas are mixed to 22 kcal/oz. En-

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### TABLE 1.

**Take Home Points**

- Breast milk is still considered to be the most ideal nutrition source for most infants
- Iron-rich formulas are preferred over low iron formulas
- Vitamin D supplementation is often needed in breast-fed and formula-fed babies
- Partially hydrolyzed protein formulas still contain large proteins and, as a result, are not truly hypoallergenic
- Many babies with a true milk allergy will also have a soy milk allergy
- Most babies can digest lactose easily, whereas lactose intolerance is common in older children and adults
- There are very few reasons why a baby would need a soy-based formula, and many avoid soy-based formulas in ex-premature infants for fears of causing osteopenia
- The jury is still out on the ideal kilocalorie/ounce formula for ex-premature babies, but it does seem wise to enrich formulas when a baby is small for gestational age
- The vast majority of healthy toddlers do not need formula
<table>
<thead>
<tr>
<th>Milk Type</th>
<th>Examples</th>
<th>Protein</th>
<th>Carbohydrate</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast milk</td>
<td>Not applicable</td>
<td>Mixed whey: casein protein ratio</td>
<td>Lactose</td>
<td>The best choice for most babies. Not for mothers with HIV or for infants with galactosemia</td>
</tr>
<tr>
<td>Full-term cow’s milk-based infant formulas</td>
<td>Enfamil® Newborn (Mead Johnson &amp; Co., Glenview, IL), Enfamil® Infant (Mead Johnson &amp; Co., Glenview, IL), Similac® Advance® (Abbott, Columbus, OH)</td>
<td>Cow’s milk protein, varies in whey:casein ratio</td>
<td>Lactose</td>
<td>A common choice for mothers who cannot breast-feed or who choose not to breast-feed</td>
</tr>
<tr>
<td>Organic cow’s milk-based infant formulas</td>
<td>Similac® Advance® Organic (Abbott, Columbus, OH), Earth’s Best Organic® Infant Formula (Hain Celestial Group, Boulder, CO)</td>
<td>Cow’s milk protein, varies in whey:casein ratio</td>
<td>Lactose</td>
<td>Similar to full-term milk-based infant formulas, but for parents with preference for organic products</td>
</tr>
<tr>
<td>Cow’s milk-based infant formulas with partially hydrolyzed protein</td>
<td>Enfamil® Gentlese (Mead Johnson &amp; Co., Glenview, IL), Gerber® Good Start® Gentle (Nestle, Florham Park, NJ)</td>
<td>Cow’s milk protein, partially hydrolyzed, (Goodstart with whey protein only)</td>
<td>Some with lactose, others without</td>
<td>Marketed for “sensitive” babies, but not truly hypoallergenic</td>
</tr>
<tr>
<td>Cow’s milk-based infant formulas with added thickener</td>
<td>Enfamil Acid Reflux® (Mead Johnson &amp; Co., Glenview, IL), Similac for Spit-Up® (Abbott, Columbus, OH)</td>
<td>Cow’s milk protein</td>
<td>Some with lactose, others without; both with added rice starch</td>
<td>Marketed for “spitty” babies</td>
</tr>
<tr>
<td>Cow’s milk-based infant formulas with little to no lactose</td>
<td>Enfamil® Gentlese (Mead Johnson &amp; Co., Glenview, IL), Similac® Sensitive® (Abbott, Columbus, OH), Earth’s Best Organic® Sensitivity Infant Formula (Hain Celestial Group, Boulder, CO)</td>
<td>Cow’s milk protein: some are partially hydrolyzed, others not</td>
<td>Nonlactose carbohydrates</td>
<td>For babies with galactosemia; marketed for babies with lactose sensitivity or lactase deficiency</td>
</tr>
<tr>
<td>Soy formulas</td>
<td>Gerber® Good Start® Soy (Nestle, Florham Park, NJ), Similac® Soy Isomil® (Abbott, Columbus, OH)</td>
<td>Soy protein</td>
<td>Nonlactose carbohydrates</td>
<td>For vegan parents, or patients with galactosemia; contains little to no lactose</td>
</tr>
<tr>
<td>Preterm infant formulas</td>
<td>Similac Expert Care® Neosure® (Abbott, Columbus, OH), Enfamil® Enfacare (Mead Johnson &amp; Co., Glenview, IL)</td>
<td>Cow’s milk protein</td>
<td>Lactose</td>
<td>Mixed at 22 kcal/oz</td>
</tr>
<tr>
<td>Extensively hydrolyzed cow’s milk-based formulas</td>
<td>Nutramigen® (Mead Johnson &amp; Co., Glenview, IL), Pregestamil® (Mead Johnson &amp; Co., Glenview, IL), Similac Expert Care® Alimentum® (Abbott, Columbus, OH)</td>
<td>Extensively hydrolyzed milk protein and amino acids</td>
<td>Nonlactose carbohydrates</td>
<td>For cow’s milk or soy milk insensitivity. Pregestamil is for patients with steatorrhea</td>
</tr>
<tr>
<td>Amino acid-based formulas</td>
<td>Neocate® Infant (Nutricia North America, Gaithersburg, MD) EleCare® Infant (Abbott, Columbus, OH)</td>
<td>Amino acids</td>
<td>Nonlactose carbohydrates</td>
<td>For severe protein allergy or short-bowel syndrome</td>
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</tbody>
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**Notes:**
- **Abbreviation:** HIV, human immunodeficiency virus.

*TABLE 2.*

**Nutrition Options for Infants**
A healthy infant is often given to support growth immediately upon discharge, but long-term outcomes remain in question. Some studies support increased growth up to age 12 to 18 months, but others show no difference compared to standard infant formulas. Another area of controversy is soy-based formulas for preterm infants. Many practitioners believe that soy-based formulas contain insufficient phosphorous to support bone health in premature babies at risk for osteopenia. At present, it seems that most practitioners, if unable to support breast-feeding, will choose an enriched cow’s milk-based formula if the premature infant is small for gestational age (<10th percentile).  

**SPECIALIZED FORMULAS**

There are many specialized formulas that are worth mentioning. The first group is extensively hydrolyzed protein formulas, which are for babies with cow’s milk or soy protein insensitivity. These formulas have milk proteins that are all small in molecular weight, usually <1,500 Da. Additionally, they are lactose-free. Examples include Nutramigen (Enfamil, Mead Johnson & Co., Glenview, IL), Pregestamil (Enfamil, Mead Johnson & Co., Glenview, IL), and Similac Expert Care Alimentum (Abbott, Columbus, OH). Pregestamil is specifically for babies with difficulties with fat absorption, such as those with hepatobiliary disease. Lastly, there are a few formulas made with free amino acids, the smallest breakdown product of proteins, which are for babies with protein malabsorption issues (such as short-gut syndrome) or severe protein allergy.

A **SHORT NOTE ON TODDLER FORMULAS**

There are numerous formulas marketed to promote toddler health. Meal times can be a struggle with toddlers, who are often interested in playing rather than eating. Parents are often running after their busy toddler to try to ensure adequate nutrition, and formula feels like an easy way to get appropriate nutrition into the child. However, the vast majority of toddlers do not need formula after they turn age 1 year, and can obtain adequate nutrients from eating a healthy diet. The AAP website has many tips on how to provide adequate nutrition for toddlers.

**CONCLUDING REMARKS**

This article was a brief glimpse at the confusing and often frustrating world of infant formulas. Hopefully, it shed a little light on some of the facts and some of the controversies (Tables 1 and 2).

**REFERENCES**