# NCC Pediatrics Continuity Clinic Curriculum: **Nutrition II: Infants & Toddlers**

**Goal:**
To understand the pediatric nutrition recommendations for *infants & toddlers* and to be able to translate them into practical, anticipatory guidance for parents.

**Pre-Meeting Preparation:**

- "Infant & Toddler Nutrition" *(Excerpts from HealthyChildren.org)*
- "Standard Infant Formula and Formula Feeding. . ." *(Pediatrics in Review)*
- "Specialized Infant Formulas" *(Pediatrics in Review)*
- "Managing Feeding Problems and Feeding Disorders" *(Pediatrics in Review)*
- "AAP Doubles Recommended Vitamin D Intake" *(AAFP, 2009)*
- "Rice Cereal Can Wait, Let Them Eat Meat" *(Pediatric News, 2009)*
- **Be prepared to provide a case-example or FAQ related to Infant & Toddler Nutrition from your continuity clinic experience.** (Examples: formula switching, food allergies, picky eaters.) Discuss how you approached the case or question.

**Conference Agenda:**

- *Review* Nutrition II Quiz
- Complete Nutrition II Case
- Round table discussion of *resident* Infant &Toddler cases

***Post-Conference:*** *Board Review Q&A*

**Extra Credit:**

Please review the following enclosures, related to the practical guidelines, above:

- "Fruit Juice in Infants, Children, and Adolescents: Current Recommendations" *(Pediatrics 2017)*
- "Prevention of Rickets & Vitamin D Deficiency" *(AAP CPG, 2008)*
- **Vitamin D: NIH Recommendations** *(NIH, 2011)*
- "Effects of Early Nutritional Interventions on Atopic Disease" *(Pediatrics, 2008)*

# Infant Nutrition

*Material adapted from: http://www.healthychildren.org/English/ages-stages/*

## Breastfeeding: *See Nutrition I Module*

## Formula Feeding: *See "Infant Formula Choice Guide" on next page*

After the first few days, your formula-fed newborn will take from **2 to 3 ounces** of formula per feeding and will eat **every three to four hours** on average during her first few weeks. During the first month, if your baby sleeps longer than four to five hours and starts missing feedings, wake her up and offer a bottle.

By the end of her first month, she'll be up to at least **4 ounces per feeding**, with a fairly predictable schedule of feedings about every four hours. By six months, your baby will consume **6 to 8 ounces** at each of four or five feedings in twenty-four hours. On average, your baby should take in about 2.5 oz of formula a day for every pound of body weight.

**Initially it is best to feed your formula-fed newborn on demand.** As time passes, he'll begin to develop a fairly regular timetable of his own. As you become familiar with his signals and needs, you'll be able to schedule his feedings around his routine. If he becomes fidgety or easily distracted during a feeding, he's probably finished. If he drains the bottle and still continues smacking his lips, he might still be hungry.

There are high and low limits, however. **Your baby should drink no more than 32 oz of formula in 24 hours**. Some babies have higher needs for sucking and may just want to suck on a pacifier after feeding.

Between two and four months of age (or when baby weighs more than 12 lbs), most formula-fed babies no longer need a **middle-of-the night feeding**, because they're consuming more during the day and their sleeping patterns have become more regular. Their stomach capacity has increased, too, which means they may go longer between daytime feedings—occasionally up to four or five hours. If your baby still seems to feed very frequently or consume larger amounts, try distracting him with play or with a pacifier. Sometimes patterns of obesity begin during infancy, so it is **important not to over-feed your baby**.

## Vitamin Supplementation:

The current AAP recommendation is that all infants and children should have a minimum intake of **400 IU of vitamin D per day** soon after birth. Breastfed infants need supplemental vitamin D. Prepared formula has vitamin D added to it; so if your baby is drinking at least **32 ounces**, supplementation is not needed. In addition, once your baby is one year old and on vitamin D milk, extra vitamins may not be needed. Please note that the NIH now recommends **600 IU of vitamin D per day** for children> 1yr. *(See "AAP Doubles Recommended Vitamin D Intake" & Extra-Credit article).*

A regular, well-balanced diet should provide all the vitamins necessary for both nursing mothers and their babies. However, pediatricians recommend that mothers continue taking a **daily prenatal vitamin.** If you are on a strict **vegetarian diet**, you need to take an extra **B-complex supplement**, since certain B vitamins are available only from meat, poultry, or fish. If your baby is on infant formula, he generally will receive adequate vitamins. *(See Nutrition III Module for Vegetarian Guidelines).*

If your baby is breastfed, there is sufficient, well-absorbed **iron** to give her an adequate supply so that no additional supplement is necessary. When she is between 4-6 months old, you should be starting baby

foods that contain supplemental iron. If you are bottle-feeding, all formula options contain sufficient iron .

## Infant Formula Choice Guide *(adapted from CHOP Dept of Clinical Nutrition)*

| Patient | Feeding | Considerations |
|---|---|---|
| **Premature infants** | Breastmilk | - Feeding of choice (except: maternal substance abuse, HIV)<br>- Fortify with HMF when at full volume feeds |
| | Enfamil Premature Lipil (Mead Johnson) | - Use for ELBW infants; higher in Vitamin A |
| | Similac Special Care Advance (Ross) | - Use if infant is osteopenic; higher in Ca/Phos |
| **Premature close to discharge** | Neosure Advance (Ross) | - *Available as ready-to-feed 22 cal/oz or powder*<br>- Has 25% MCT |
| | Enfacare (Mead Johnson) | - *Available as ready to feed 22 cal/oz or powder*<br>- Has 20% MCT<br>- Has slightly more Ca/Phos |
| **Full term** | Breastmilk | - Feeding of choice (except: maternal substance abuse, HIV) |
| | Good Start Supreme (Gerber) | - Whey PRO hydrolysate<br>- Low renal solute load (use if breastmilk not available) |
| | Enfamil Lipil (Mead Johnson) | - Higher in DHA/ARA than Similac Advance<br>- Whey:Casein ratio 60:40. *Ready-to-feed 20 & 24 cal/oz* |
| | Similac Advance (Ross) | - Lower in DHA/ARA than Enfamil Lipil<br>- Whey:Casein ratio 48:52. *Ready-to-feed 20 cal/oz only* |
| **Chylothorax** | Portagen (Mead Johnson) | - Only indication: chylothorax/ chylous ascites<br>- Has 85% MCT |
| **Galactosemia Lactose Intol. Vegetarian** | Isomil (Ross) | - Soy formula containing sucrose and corn syrup |
| | Prosobee (Mead Johnson) | - Sucrose-free soy formula |
| **Full Term w/ 2$^{o}$ Lactose Intolerance** | Similac Lactose Free (Ross) | - Lactose-free cow's milk based<br>- Whey:Casein ratio 20:80<br>- NOT for preterm infants |
| **Cow's Milk Protein Allergy** | Similac Expert Care Alimentum (Ross) | - Protein:Casein hydrolysate<br>- Contains sucrose (sweeter taste)<br>- Lactose free |
| | Nutramigen (Mead Johnson) | - Protein:Casein hydrolysate<br>- Sucrose & Lactose free |
| | Neocate (SHS) | - Amino acid based (elemental)<br>- Sucrose, lactose, soy, whey, and casein free (for severe allergy)<br>- Use if patient is having heme-(+) stools on above formulas |
| | Elecare (Ross) | - Amino acid based (elemental)<br>- Sucrose, lactose, soy, whey, and casein free (for severe allergy)<br>- Use if patient is having heme-(+) stools on above formulas |
| **Malabsorption** | Similac Expert Care Alimentum (Ross) | - Protein:Casein hydrolysate<br>- Contains sucrose; Lactose free<br>- Has 33% MCT<br>- *Available ready-to-feed 20 cal/oz only* |
| | Pregestimil (Mead Johnson) | - Protein:Casein hydrolysate<br>-Sucrose & Lactose free<br>- Has 55% MCT<br>- *Available ready-to-feed 20 & 24 cal/oz* |
| | Neocate (SHS) | - Amino-acid based (Elemental)<br>- Use if pt has heme(+) stools on above formulas or fails to tolerate<br>- Has 5% MCT (LCT may be trophic for short gut patients). |
| | Elecare | - Amino-acid based (elemental) |

| | | |
|---|---|---|
| | (Ross) | -Use if pt has heme(+) stools on above formulas or fails to tolerate<br>-Has 33% MCT (LCT may be trophic for shot gut patients)<br>- 10% less CHO than Neocate |

## Water & Juice:

Until your baby starts eating solid foods, he'll get all the water he needs from breastmilk or formula. **In the first six months, additional water or juice is generally unnecessary.** After a bottle-fed baby is six months old, you may offer him water between feedings, but don't force it on him or worry if he rejects it. Breastfed infants generally do not need extra water if they are permitted adequate access to the breast for feeding.

Once your baby is eating solid foods, his need for liquid will increase. Getting your infant used to the taste of plain water is a healthy habit that will last a lifetime. **Juice is not recommended; although if you do give your infant juice, make sure your child's daily juice intake does not exceed 4 to 6 ounces**. Most fruit juices do not contain any significant amount of protein, fat, minerals, or vitamins other than vitamin C. *(See Extra Credit—"Fruit Juice in Infants, Children, and Adolescents- Current Recommendations")*

Some children who drink too much juice have an increased risk of being overweight. To help regulate the amount of fruit juice your child drinks, offer juice with food to slow down the rate at which it's absorbed, and serve a combination of **one-half juice and one-half water**.

## Introducing Solid Foods:

**Most babies are ready to eat solid foods at 4 to 6 months of age.** Before this age, instead of swallowing the food, babies push their tongues against the spoon or food, a reflex necessary for breast or bottle-feeding. In addition, by 6 months of age, most babies are able to sit independently. Finally, energy needs begin to increase, making this a good time to introduce solids.

**Start with simple, basic foods such as rice cereal**. You should add breast milk or warm formula to the cereal, mixing about 1 tablespoon of cereal with every 4 to 5 tablespoons of breast milk. Look for infant cereals that are fortified with iron, which provide about 30-45% of your infant's daily iron needs. **Newer guidelines recommend pureed meats as the first solid food, based on their high protein, iron, and zinc content** *(See "Rice Cereal Can Wait").*

Here are some additional recommendations to keep in mind:

- Introduce your baby to other solid foods gradually. Good initial choices are other simple cereals, such as oatmeal, as well as vegetables and fruits. **Most pediatricians recommend offering vegetables before offering fruits**. However, there is no medical evidence that introducing solid foods in any particular order has an advantage for your baby.
- **Start these new foods one at a time, at intervals of every 2 to 3 days**. This approach will allow your infant to become used to the taste and texture of each new food. It can also help you identify any food sensitivities or allergies that may develop as each new food is started.
- In the beginning, feed your infant small serving sizes—even just **1 to 2 small spoonfuls to start**.
- **Within about 2 to 3 months** after starting solid foods, your infant should be consuming a daily diet that includes not only breast milk or formula, but also cereal, vegetables, fruits, and meats, divided among **3 meals**.
- Some pediatricians advise introducing wheat and mixed cereals last because young babies could have **allergic reactions** to them. Many pediatricians also recommend against giving eggs and fish in the first year of life because of allergic reactions. There is no evidence that introducing these foods after 4

to 6 months of age determines whether your baby will be allergic to them, and in fact there is evidence to say that the opposite is true. *(See Extra-Credit).*

- When your infant is about **8 to 9 months old**, give her ***finger* foods or table foods** that she can pick up and feed to herself. Do not give small infants raisins, nuts, popcorn, or small or hard food pieces that can be easily aspirated.

# Toddler Nutrition

*Material adapted from: http://www.healthychildren.org/English/ages-stages/*

## Feeding Your One-Year Old

You'll probably notice a sharp **drop in your toddler's appetite** after his first birthday. It may seem as if he should be eating more now that he's so active, but there's a good reason for the change. His growth rate has slowed, and he really doesn't require as much food now.

Your toddler needs about **1,000 calories a day** to meet his needs, generally divided among **three small meals and two snacks** a day. Don't count on his always eating it that way, however, because the eating habits of toddlers are erratic and unpredictable from one day to the next. Your child's needs will vary, depending on his activity level, his growth rate, and his metabolism.

Remember that cholesterol and other fats are important for your toddler's growth and development, so they should not be restricted. Babies and young toddlers should get **about half of their calories from fat**. You can gradually decrease the fat consumption once your child has reached the age of two (lowering it to about one-third of daily calories by ages four to five).

By his first birthday, your child should be able to handle most of the foods you serve the rest of the family—but with a few **precautions**. First, be sure the food is cool enough so that it won't burn his mouth. Also, don't give foods that are heavily spiced, salted, buttered, or sweetened. These additions prevent your child from experiencing the natural taste of foods and may be harmful to long-term health.

Finally, your little one can still **choke on chunks of food that are large enough to plug his airway**. Keep in mind that children don't learn to chew with a grinding motion until they're about four years old. Make sure anything you give him is mashed or cut into small, easily chewable pieces. Never offer him peanuts, whole grapes, cherry tomatoes (unless they're cut in quarters), carrots, seeds (i.e., processed pumpkin or sunflower seeds), whole or large sections of hot dogs, meat sticks, or hard candies (including jelly beans or gummy bears), or chunks of peanut butter (it's fine to thinly spread peanut butter on a cracker or bread). Hot dogs and carrots in particular should be quartered lengthwise and then sliced into small pieces. Also make sure your toddler eats only while seated and supervised by an adult.

## Feeding Your Two-Year Old

By age two, your toddler should be eating **three healthy meals a day plus one or two snacks**. He can eat the same food as the rest of the family. With his improved language and social skills, he'll become an active participant at mealtimes if given the chance to eat with everyone else.

**Do not fixate on amounts and do not make mealtimes a battle.** Many toddlers resist eating certain foods, or for long periods insist on eating only one or two favorite foods. The more you struggle with your child over his eating preferences, the more determined he'll be to defy you. If he rejects everything, you might try saving the plate for later when he's hungry. However, don't allow him to fill up on cookies or sweets after refusing his meal, since that will just diminish his appetite for nutritious ones.

Offer him a selection of nutritious foods at each sitting, and let him choose what he wants. Vary the tastes and consistencies as much as you can. He may be more interested in healthful foods if he can feed them to himself. So, whenever possible, **offer him finger foods** (i.e., fresh fruits or raw vegetables other than carrots and celery) instead of cooked ones that require a fork or spoon to eat. Hard as it may be to believe, your child's diet will balance out over several days if you make a range of wholesome foods available and don't pressure him to eat a particular one at any given time.

Fortunately, your child's feeding skills have become relatively "civilized" by now. At age two, he **can use a spoon, drink from a cup with just one hand**, and feed himself a wide variety of finger foods. But while he can eat properly, he's still learning to chew and swallow efficiently, and may gulp his food when he's in a hurry to get on with playing. Continue to avoid the "chokable" foods, listed above.

Vitamin supplements are rarely necessary for toddlers who eat a varied diet. However, **supplemental iron** may be needed if your child eats very little meat, iron-fortified cereal, or iron-rich vegetables. Large quantities of milk (more than 32 oz/day) also may interfere with the proper absorption of iron. Your child should drink 16 oz of low-fat or nonfat milk each day. This will provide most of the calcium he needs for bone growth and still not interfere with his appetite for other foods, particularly those that provide iron.

A **vitamin D supplement of 600 IU per day** is important for children who are not regularly exposed to sunlight, are consuming less than 32 ounces per day of vitamin D–fortified milk, or do not take a daily multivitamin containing at least 400 IU of vitamin D.

## Feeding Your Three-Year Old

As a preschooler, your child should have a **healthy attitude toward eating**. Ideally, by this age she no longer uses eating—or not—to demonstrate defiance, nor does she confuse food with love or affection.

Despite your preschooler's general enthusiasm for eating, she still may have very **specific preferences**, some of which may vary from day to day. As irritating as it may be to have her turn up her nose at a dish she devoured the day before, it's normal behavior for a preschooler, and best not to make an issue of it. Let her eat the other foods on her plate or select something else to eat.

However, **encourage her to try new foods** by offering her very small amounts to taste, not by insisting that she eat a full portion of an unfamiliar food. Your job is to make sure that your preschooler has nutritious choices at every meal. **Keep giving healthy foods** to her even if she repeatedly turns up her nose at the sight of them. Before long, she may change her mind. *(See "Helping Preschoolers. . .")*

**Television advertising** can be a serious obstacle to your preschooler's good nutrition. Some studies show that children who watch over twenty-two hours of TV per week (over 3 hrs/day) have a greater tendency to become obese. Children this age are extremely receptive to ads for candy and other sugary sweets, especially after they've visited other homes where these foods are served.

## Feeding Your Four-Year Old

Between the ages of 4 and 5 years, you can start to gradually reduce the levels of fat that your child consumes. By serving her lower fat meals, you'll help keep her weight under control and lower her risk of heart disease and other chronic illnesses later in life. At this time, most of your family's calories (about 55% to 60%) should come from carbohydrates, with more modest amounts of fat and protein.

What kind of fat-reducing changes should you be making?

- Switch your preschooler from whole milk to skim or 2% milk. She should be drinking 2 cups a day of fat-free or low-fat milk (or equivalent milk products).

- Select grilled or broiled fish or lean meats and avoid fried meats. The advantage is that more quality protein is consumed and this develops a healthier habit for life.
- Serve cheese only in modest portions.
- Give your child whole fruit to meet her recommended fruit intake, limiting fruit juice consumption to no more that 4 to 6 oz per day (from ages 1 to 6 years). Remember, this is 100% juice, not juice drinks.
- For snacks, rely on low-fat choices like pretzels, fresh fruit, air-popped popcorn, or low-fat yogurt.
- When preparing food, use cooking methods like steaming, broiling, and roasting.

# Standard Infant Formula and Formula Feeding–Cow Milk Protein Formulas

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**AUTHOR DISCLOSURE** Dr Milbrandt has disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

The number and variety of infant formulas have increased tremendously during the past decade. Although standard infant formulas make up approximately 75% of the infant formulas currently sold, the remaining include a variety of specialized formulas that are designed for specific medical indications or symptoms. This *In Brief* presents information on standard infant formulas, and a separate *In Brief* focuses on specialized formulas.

Despite the preponderance of evidence that human milk has a large variety of nutritional and nonnutritional advantages, the most recent data from the Centers for Disease Control and Prevention (CDC) (2015) indicate that only 79% of women will start breastfeeding their babies at birth, and by 6 months of age that proportion drops to approximately 19%. Based on the birth of approximately 4,000,000 infants during the time of data collection, nearly 1,000,000 infants were fed formula from birth and more than 3,000,000 received at least some formula by 6 months of age. The large number of formula choices available to families can be confusing. Thus, pediatricians should have a good working knowledge of the infant formula products available on the market, any benefits and/or ramifications from specific formula choices, as well as the knowledge to identify the small percentage of infants who might require a specialized infant formula.

The use of alternatives to human milk dates back to 4,000 years ago. Over time, the most commonly used substitute was cow milk, but a variety of different animal milks have been used, including sheep, goat, and camel, based on availability. In the late 18th century, scientific interest led to the comparison of the composition of human milk with that of a variety of different animal milks. In the mid-1860s, chemist Justus von Liebig developed and patented the first infant formula based on cow milk, a powdered formula made from wheat flour, cow milk, malt flour, and potassium bicarbonate. Soon after this, and continuing for more than a century, many other infant formulas were introduced to the market.

The Infant Formula Act of 1980 authorized the Food and Drug Administration (FDA) to ensure quality control of infant formulas. Based on American Academy of Pediatrics (AAP) recommendations, a standard list of 29 nutrients was to be present in all infant formulas. In 2014, the FDA finalized a rule that set standards for manufacturers of infant formulas. These standards required manufacturers to prove that the infant formulas they produce support normal physical growth, to test for nutrient content in the final product stage and at the end of the product shelf life, and to undergo yearly FDA inspections at all facilities. Because both brand name and store brand infant formulas are subjected to the same standards, brand name infant formulas should not be considered superior to store brand formulas. Thus, parents may choose the significant cost savings of a store brand formula without hesitation.

**Breastfeeding and the Use of Human Milk.** AAP Section on Breastfeeding. *Pediatrics*. 2012;129(3):e842–e856

**A History of Infant Feeding.** Stevens E, Patrick T, Pickler R. *J Perinatal Educ*. 2009;18 (2):32–39

**Infant Formulas.** Martinez JA, Ballew MP. *Pediatr Rev*. 2011;32(5):179–189

**Breast Feeding Report Card: United States/ 2014.** National Center for Chronic Disease Prevention and Health Promotion. CDC website. Available at: http:/www.cdc.gov/breastfeeding/pdf/2014breastfeedingreportcard.pdf. Published July 2014. Accessed May 2016.

**Choosing a Formula.** American Academy of Pediatrics. Healthychildren.org website. Available at: https://healthychildren.org/English/ages-stages/baby/feeding-nutrition

**Questions and Answers for Consumers Concerning Infant Formula.** US Food and Drug Administration. US FDA website. Available at: https://www.fda.gov:80/FDAgov/ForConsumers/ConsumerUpdates/ucm048694.htm

In standard infant formulas, the protein source is cow milk, lactose is the main carbohydrate source, and the fats are from a blend of vegetable oils. Standard infant formulas are available in powder or liquid concentrates to be mixed with a predetermined amount of water and as ready-to-use liquids, with caloric densities of 19 to 20 kcal/oz. Both the powder and concentrate preparations allow for the formula to be mixed with less water to provide a higher caloric density when needed. Iron is an essential mineral, and the AAP currently recommends that from birth to 1 year of age a standard, iron-fortified formula be used for all infants who are not breastfed. Although low-iron formulas are available, they should be considered nutritionally inadequate and are not recommended.

Because levels of long-chain polyunsaturated fatty acids (LCPUFAs), specifically, docosahexaenoic acid (DHA) and arachidonic acid (ARA), had been found to be higher in the brains of breastfed infants compared with those formerly fed formula, LCPUFAs have been included in most marketed standard infant formulas since 2002. The addition of LCPUFAs is marketed as improving the visual development and neurodevelopment of infants. Although early meta-analyses did not support this claim, more recent studies examining infants fed with higher doses of DHA and ARA have reported benefits. However, because most randomized control trials do not support these claims, there is no recommendation for the routine supplementation of infant formula with LCPUFAs.

Because of parental perceptions of changes in bowel movements being a potential reason for formula changes, physicians need to be familiar with the difference in the feeding and stooling patterns of breastfed versus formula-fed infants. Infants who are formula fed generally take larger, less frequent feeds than breastfed infants. The stools of formula-fed infants tend to be thicker in consistency, darker in color, and less frequent than those of breastfed infants during the first few weeks after birth. Overall, the volume of stool tends to be the same for breastfed and formula-fed infants. However, there is some variation based on the type of infant formula used. Specifically, infants fed hydrolyzed protein formulas have stooling patterns and stool appearance more like those of breastfed infants.

A variety of specialized infant formulas are also available on the market, with a significant number of new products available in the past decade. These will be discussed in an upcoming *In Brief* on specialized infant formulas.

**COMMENT:** Guiding parents through formula options is an important component of anticipatory guidance by primary care providers Although it can be challenging to reassure parents that gassiness, minimal grunting with defecation, spitting up, and crying in the first few weeks after birth may be normal behaviors or symptoms in young infants, assisting families in these decisions is an important part of our job. However, families may not seek advice but instead make the changes on their own based on symptoms they have observed or advice from family members. I am reminded of 2 interesting studies that Dr Brian Forsythe and colleagues published. In the first study, published in 1985, his team interviewed a group of mothers when their infants were 4 months of age. They found that the mothers of infants who underwent formula changes were more likely to think that their infant had an intrinsic problem, such as an illness. When these mothers were again interviewed 3½ years later, those whose children were managed with formula changes for perceived feeding problems or crying were more likely to perceive their children as vulnerable (relative risk, 2.18; 95% confidence interval, 1.05–4.53). These studies raise concerns that benign formula changes may not always be innocuous and pediatricians need to seriously consider and identify infants who truly meet the criteria for a change in formula.

– Janet R. Serwint, MD
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# Specialized Infant Formulas

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**AUTHOR DISCLOSURE** Dr Milbrandt has disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

As reported in a previous *In Brief* on standard infant formulas, there are many choices for both standard (cow milk protein formulas) and specialized infant formula products available on the market. It is, therefore, incumbent on the pediatrician to have a good working knowledge of the indications for and benefits of the use of specialized formulas. This *In Brief* addresses the topic of specialized infant formulas.

The first soy formula was marketed in the 1920s, and soy formula currently makes up most of the nonstandard infant formulas sold, which includes approximately 20% of the US formula market. Soy formulas contain soy as the protein, and the primary carbohydrate sources are glucose polymers, corn syrup, maltodextrin, and sucrose. Hence, all soy formulas are lactose free. Although the American Academy of Pediatrics generally supports the use of standard cow milk protein infant formulas as the formula of choice for those who choose not to breastfeed, there are a few circumstances in which soy formulas should be selected. Children with galactosemia and hereditary lactase deficiency need to eliminate lactose intake from their diet, and families seeking a vegan alternative want to avoid the cow milk protein. It is rare for infants to have significant lactose intolerance before 2 years of age, hence there is little evidence that soy formulas or lactose-reduced or lactose-free formulas reduce the symptoms of colic or stooling difficulties despite the perceptions of parents. Soy formula is not recommended for use in preterm infants with a birthweight less than 1,800 g because premature infants who have been fed this have had lower serum phosphorous levels, higher alkaline phosphatase levels, and an increased degree of osteopenia. Also, for infants suspected of having a cow milk protein allergy (CMPA), soy formula should not be used because 5% to 14% of those who have cow milk allergy also have soy protein allergy. Concerns have been raised about the potential effects of phytoestrogens and isoflavones, which are present in higher levels in soy formula. However, retrospective follow-up studies of adults who were fed exclusively with soy formula during infancy show no reproductive or estrogen-related consequences.

During the past decade, a variety of more specialized infant formulas have reached the market. These formulas claim to treat or prevent conditions such as fussiness, gastroesophageal reflux disease (GERD), and atopy, among others. These formulas include those that may contain partially hydrolyzed proteins, carbohydrate blends that are lactose free or lactose reduced, thickeners, prebiotics/probiotics, or a combination thereof. The evidence is inconclusive as to whether these formulas make a difference for children with GERD or fussiness.

Formulas that contain partially hydrolyzed cow milk protein (PHFs) or extensively hydrolyzed cow milk protein (EHFs) are another group of specialty formulas. Hydrolyzed proteins consist of a combination of short-chain peptides and free amino acids. There is evidence that the use of EHFs or PHFs in high-risk infants (first-degree relatives who had allergy) reduces infant and childhood

**Infant Formulas.** Martinez JA, Ballew MP. *Pediatr Rev.* 2011;32(5):179–189

**Use of Soy Protein-Based Formulas in Infant Feeding.** Bhatia J, Greer F. *Pediatrics.* 2008;121(5):1062–1068

**Infantile Colic: Crying Time Reduction with a Whey Hydrosylate: A Double-Blind, Randomized, Placebo-Controlled Trial.** Lucassen PL, Assendelft WJ, Gubbels JW, van Eijk JT, Douwes AC. *Pediatrics.* 2000;106(6):1349–1354

**Questions and Answers for Consumers Concerning Infant Formula.** US Food and Drug Administration. US FDA website. Available at: https://www.fda.gov:80/FDAgov/ForConsumers/ConsumerUpdates/ucm048694.htm

allergy and atopic dermatitis compared with standard cow milk–based formula. There is no evidence that the hydrolyzed formulas are superior to human milk in preventing these conditions. True CMPA has an incidence of 2% to 5% in infants. Infants with a confirmed diagnosis of CMPA should be fed human milk or, if formula fed, EHFs. A more severely affected group of infants, including those with non-IgE–mediated enterocolitis, failure to thrive, severe eczema, and/or symptoms during exclusive breastfeeding, may respond better to elemental/amino acid–based formulas than to hydrolyzed formulas that additionally contain short-chain peptides. Hence, if an infant does not respond appropriately to EHF, an elemental formula is next trialed. A small number of infants with colic do respond to hydrolyzed formulas, so a short trial of these formulas could be considered.

Formulas marketed to treat GERD include rice starches and/or other thickeners. The data are also mixed and inconclusive as to whether thickened milk is associated with reduced GERD symptoms such as crying and irritability. Prethickened formulas are not superior to the postmarket addition of cereals to standard infant formula or human milk. Owing to the recent concerns about arsenic in rice, and the prolonged exposure to rice cereals in infants that use thickened formulas, the American Academy of Pediatrics has made a recommendation to substitute oatmeal instead of rice cereal for postmarket thickening of formula or human milk. Commercial thickening agents should not be used owing to the association with necrotizing enterocolitis.

The addition of prebiotics and probiotics to some infant formulas is designed to more closely align the intestinal flora of formula-fed infants to that of breastfed infants. Specifically, most intestinal flora in breastfed infants consists of *Bifidobacterium* and *Lactobacillus*. Meta-analyses show that there is some evidence that the addition of prebiotics (nondigestible carbohydrates that promote the development of these bacteria in the colon) or probiotics (live organisms that colonize the colon) to infant formula may prevent the atopic conditions eczema and asthma. These bacteria seem to be an integral part of the development of the intestinal and systemic immune response. In addition, they are believed to be a component of the development of protection against pathogen colonization in the gut and aid nutrient absorption. There is also evidence that probiotics may prevent necrotizing enterocolitis in very low birthweight (1,000–1,500 g) infants.

In summary, there are myriad infant formula choices available to families. During the past 15 years there have been significant strides by infant formula manufacturers to more closely mimic the gold standard, human milk. There are data to support claims of health benefits from some of these changes, but not for all. The pediatrician plays an integral role in navigating these choices.

**COMMENT:** Only a small proportion of infants truly meet the criteria to require a specialized formula. Pediatricians need to be knowledgeable about these criteria and provide accurate advice. Although it used to be relatively easy to know the components of specialized formulas based on their names (ie, soy formulas had soy in their name and those with hydrolyzed proteins were confined to a few brands, the more widespread incorporation of hydrolyzed protein in brand names that were previously standard formulas has made this confusing. Specialized formulas for reflux, gassiness, or fussiness may have modifiers such as gentle, sensitive, for spit up, etc.

Special formulas for preterm infants have been developed and used for infants in the NICU, although breastfeeding is always encouraged. These preterm formulas have a higher caloric density of 24 kcal/oz and contain higher amounts of taurine, whey as the predominant protein, medium-chain triglycerides, calcium, phosphorous, and vitamins A and D. Preterm formulas are usually discontinued at hospital discharge when the infant weighs between 1,800 and 2,000 g and is approximately 34 weeks' gestation. These formulas are then replaced with preterm transitional formulas that have caloric densities of 22 kcal/oz and are continued until 6 to 9 months of age. Dr Milbrandt's *In Brief* can serve as a helpful guide to pediatricians to navigate formula choices.

– Janet R. Serwint, MD
Associate Editor, *In Brief*

# Managing Feeding Problems and Feeding Disorders

James A. Phalen, MD*

Author Disclosure
Dr Phalen has disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

## Educational Gap

**Up to 50% of typically developing children and up to 80% of those who have developmental disabilities have feeding problems. These may evolve into a feeding disorder, with potential effects on psychomotor and neurologic development. (1) (2)**

## Objectives

**After completing this article, readers should be able to:**

1. **Understand normal feeding patterns in children.**
2. **Recognize that feeding problems are common.**
3. **Prevent or ameliorate feeding problems.**
4. **Distinguish between feeding problems and feeding disorders.**
5. **Treat a child who has a feeding disorder.**

## Introduction

Feeding plays a central role in the parent-infant relationship. The developmental progression of food selectivity is primarily determined by a child's ability to manipulate, chew, and swallow food (Table 1). Functional, safe feeding requires coordination of sensorimotor function, swallowing, and breathing. Children self-regulate and may vary their oral intake up to 30% per day with no ill effect on growth. Caregivers are responsible for *what, when, and where* their children eat; the child is responsible for *how much and whether* they eat. Normal feeding depends on the successful interaction of a child's health, development, temperament, experience, and environment. Altering any of these factors can result in a feeding problem. (1)

### Common Feeding Problems

Symptoms of feeding problems include food refusal, regurgitation, gagging, or swallowing resistance (Table 2). (1) (3) Although the child maintains adequate growth, the behavior causes distress for caretakers. Factors that increase a child's risk for feeding problems, particularly during transition to more advanced textures, are listed in Table 3.

Between 25% and 50% of typically developing children and up to 80% of those with developmental disabilities have feeding problems. However, these problems are usually transient and cause no serious outcomes. (1) Feeding problems are thus the norm. Practitioners must consider cultural and ethnic differences and adjust for prematurity when setting expectations for feeding. Some fundamental mealtime rules apply to toddlers and older children and can prevent or resolve many feeding problems (Table 4). If a child is otherwise healthy and growing well, practitioners can reassure caregivers.

## Abbreviations

| | |
|---|---|
| BMI: | body mass index |
| CDC: | Centers for Disease Control and Prevention |
| GERD: | gastroesophageal reflux disease |
| g-tube: | gastrostomy tube |
| W/L: | weight-length ratio |

## Feeding Disorder

A *feeding disorder* is any condition in which a child has an inability or difficulty in eating or drinking sufficient quantities to maintain optimal nutritional status, regardless of cause. Growth may be unaffected. Between 3% and 10% of children are affected. Feeding disorders are multifactorial and may begin with the child (Table 3), the parents, or the

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## Table 1. Developmental Progression of Food Selectivity Based on Motor Skills

| Age, mo | Food Consistency | Fine and Gross Motor Skill | Oral Motor Skill |
|---|---|---|---|
| 0–4 | Liquid | Dependent on outside support<br>Head control emerging | Suckling present<br>Protective reflexes |
| 4–6 | Infant cereal<br>Puréed fruits and vegetables | Sits briefly<br>Head control improves<br>Brings hands to midline<br>Clasps bottle but needs help | Suckles more efficiently<br>Sucks foods rather than phasic biting<br>Eats messily from spoon |
| 6–9 | Puréed meats<br>Variety of puréed baby food | Independent sitting<br>Reaches for food<br>Begins to finger feed<br>Unrefined pincer grasp<br>Holds bottle independently<br>Assists with spoon | Sips messily from cup<br>Vertical munching<br>Limited lateral tongue action<br>Clears spoon with upper lip<br>Bite and release pattern<br>Breaks off pieces of meltable solids |
| 9–12 | Ground and lumpy purées<br>Mashed table foods<br>Soft, dissolvable solids | Sits in variety of positions<br>Refined pincer grasp<br>Finger feeding refined<br>Grasps spoon with whole hand<br>Grasps cup handle | Lip closure for liquids and soft solids<br>Spoon clearing more efficient<br>Cup drinking with assistance<br>Begins drinking from spouted cup<br>Begins to drink through a straw |
| 12–18 | Finely chopped table foods<br>Chews juicy foods<br>Bites through crunchy foods (cookies, crackers) | Scoops food<br>Brings to mouth<br>More independent feeding | Lateral tongue action<br>Diagonal chewing<br>Begins drinking from straw<br>Upper teeth clear food from lower lip |
| 18–24 | More chewable solids | Handles finger foods, spoon, and cup largely independently<br>Booster chair | Rotary chewing<br>Cup drinking improved<br>Minimal food lost during eating |
| 24–36 | Tougher solids | Total self-feeding | Mature chewing for tougher solids<br>Open cup drinking without spilling<br>Variety of liquids through straw<br>Tongue clears food from lips |
| ≥36 | Advanced textures (meats, fried foods, whole fruits) | Begins using fork to stab food | Open cup independently |

environment (Table 5). (2) Regardless of its origins, it affects the parent-child dyad and often evolves into a behavioral problem. Older children may experience low self-esteem and social isolation.

## Evaluation of Feeding Disorders

Initial evaluation of feeding disorders begins with the primary care practitioner, who should assess parental coping, mental health, and bonding. Most parents whose children have feeding disorders describe feeling frustrated and distressed at mealtime. The growth chart (length, weight, and weight-length ratio [W/L], or body mass index [BMI]) should be reviewed. True failure to thrive is a sustained decrease in growth velocity, best defined as a W/L or BMI below the fifth percentile. Failure to thrive usually results from inadequate energy intake but may reflect inadequate nutrient absorption or increased energy requirements. Although growth charts exist for specific conditions, the Centers for Disease Control and Prevention (CDC) recommend that practitioners use the World Health Organization growth standards to monitor growth for infants and children ages 0 to 2 years in the United States (available at http://www.cdc.gov/GrowthCharts/who_charts.htm) and CDC growth charts to monitor growth for children ages 2 to 20 years in the United States (available at http://www.cdc.gov/GrowthCharts/cdc_charts.htm).

A thorough review of the child's prenatal, birth, and medical histories should focus on the following key areas:

**Table 2. Common Feeding Problems in Children**

| |
|---|
| Delayed development of oral motor and self-feeding skills; common in infants and children with hypotonia, global developmental delay or intellectual disability, and neurologic disorders |
| Reluctance or refusal to eat based on sensory issues (eg, taste, texture, temperature, smell, or appearance) |
| Food selectivity (eg, personal preference, discomfort with certain foods because of gastroesophageal reflux disease, or food allergy) |
| Decreased appetite for or interest in food |
| Slow feeding (ie, >30 minutes to finish) |
| Food pocketing (ie, holding food in cheeks or front of mouth for prolonged periods) suggests poor oral transport or refusal |
| Using feeding behaviors to comfort, self-soothe, or self-stimulate |

- *Small for gestational age*. Up to 15% of infants born small for gestational age fail to achieve appropriate catch-up growth by age 2 years and continue to experience poor growth throughout childhood. Rapid catch-up growth before age 2 years in this group increases the risk of developing metabolic disease later in life. (4) (5) (6) Thus, practitioners must temper attempts to promote catch-up growth against the risks. It is reasonable to aim for a W/L or BMI between the 10th and 50th percentiles in this population.

**Table 3. Pediatric Conditions Associated With Feeding Problems and Feeding Disorders**

| |
|---|
| Temperamental traits that complicate feeding and overwhelm parents |
| Prematurity (especially neonates who require prolonged respiratory support or enteral feeds or with delayed introduction of oral feeds) |
| Genetic or chromosomal abnormalities (eg, Down syndrome and inherited neuromuscular disease) |
| Craniofacial anomalies (eg, Pierre-Robin sequence and cleft palate) |
| Acquired brain impairment (eg, cerebral palsy, stroke, and traumatic brain injury) |
| Gastrointestinal disorders (eg, gastroesophageal reflux disease and chronic constipation) |
| Neurodevelopmental disorders (eg, autism spectrum disorder, global developmental delay, and intellectual disability) |

- *Aspiration*. Aspiration involves passage of secretions, drink, or solid food below the true vocal cords. It may occur before, during, or after swallowing or from gastroesophageal reflux. Signs include coughing, throat clearing, gurgling voice, noisy breathing, recurrent wheezing or stridor, and recurrent lower respiratory tract infections. Some children aspirate with no obvious symptoms; this condition is called *silent aspiration* and suggests lack of a protective reflex. (7) Aspiration suggests oral motor delay or oropharyngeal dysphagia. Infants and children who have *oral motor delay* typically have oral hypotonia and an underdeveloped suck-swallow-breathe pattern. Thus, they may have poor lip closure, drooling after age 12 months, lack of tongue lateralization, and loss of food from the mouth (Table 1). *Oropharyngeal dysphagia*, however, is pathologic difficulty swallowing because of underlying neurologic or structural abnormalities.
- *Motor disabilities (eg, cerebral palsy and spina bifida)*. Children with motor disabilities are less mobile than neurotypical children and thus have lower energy requirements. A W/L or BMI greater than the 50th percentile makes hygiene, mobility, and transfers (eg, wheelchair to tub) more challenging and increases the risk of medical complications of obesity through excessive caloric intake.
- *Gastroesophageal reflux disease (GERD)*. Signs of GERD include regurgitation, postprandial emesis, choking, gagging, food refusal, constant or sudden crying, irritability, poor sleep patterns, apnea, stridor, laryngospasm, bronchospasm, and hoarseness. *Eosinophilic esophagitis* deserves consideration in any child presenting with symptoms of GERD in whom a trial of medical therapy with a proton pump inhibitor fails, especially in the setting of atopy. Persistent symptoms and food impaction (food getting stuck in the esophagus) should raise additional concern.
- *Constipation*. Signs and symptoms of constipation include bulky, painful, or infrequent bowel movements, failed attempts to stool, bloody stools, anal fissures, urinary incontinence, and overflow incontinence (encopresis). Parents often confuse the latter with diarrhea. Chronic constipation may cause early satiety and reduced caloric intake. Stool withholding exacerbates constipation and may have psychosocial consequences.
- *Medications*. Medications that can cause excessive sedation or decreased appetite include stimulants, selective serotonin reuptake inhibitors, and topiramate.

Pica and rumination are more likely to occur in individuals who have developmental disabilities, psychiatric disorders, or physiologic conditions (eg, iron deficiency and pregnancy).

## Table 4. Mealtime Rules for Toddlers and Older Children

| Feature | Rules | Benefit |
|---|---|---|
| Scheduling | Regular meals with planned, low-calorie snacks | Prevents "grazing" |
| | Same room, table, and utensils for every meal | Enhances sense of hunger and satiety |
| | Limit mealtime to 30 minutes (ie, "kitchen is open") | Caregivers maintain control of feeding schedule |
| | Offer no liquids between meals except plain water (ie, "kitchen is closed") | Home is less chaotic |
| Environment | Family sits together at mealtime | Focus is on socializing rather than eating |
| | Neutral atmosphere (no forced feeding or comments regarding intake) | Avoids conflict |
| | Eliminate distractions: turn off all electronic devices, child sits with back to open room | Allows child to focus on mealtime |
| | Allow younger child to explore foods by touching, smelling, and tasting | Mealtime is more pleasant |
| | Allow older child to participate in food purchase and meal preparation | |
| | Never use food as a reward, bribe, or incentive | |
| | Praise child for showing interest in food | |
| | Allow at least 20 exposures to new foods for acceptance | |
| Methods | Optimal feeding posture:<br>• Head midline and neck neutral or slightly flexed<br>• Trunk symmetrical and elongated<br>• Pelvis stable with hips symmetrical in neutral position<br>• Hips, knees, and ankles each at 90° | More likely to consume calorically dense foods<br>Expands food repertoire<br><br>Promotes independence<br>Prevents constipation and anemia from excessive milk intake<br>Prevents loose stools and dental caries from excessive juice intake |
| | Serve food at table for everyone from same container | |
| | Small portions | |
| | Small easily chewed bites or long thin strips child can grasp | |
| | Offer liquids only after child begins eating solids | |
| | Offer plain, unflavored water as primary beverage | |
| | Limit daily intake of low-fat or fat-free white or flavored milk to:<br>• 2 cups for children ages 2 to 3 years<br>• 2½ cups for children ages 4 to 8 years<br>• 3 cups for those 9 years and older | |
| | Do not dilute fruit juice, and limit to 4 to 6 oz per day | |
| | Discourage sweetened beverages (soft drinks and sports or energy drinks) | |
| | Encourage self-feeding (eg, finger feeding and holding spoon) | |
| | Food chaining: offer unfamiliar or nonpreferred foods first and paired with familiar or preferred foods | |
| | Avoid excessive coaxing, threatening, or forced feeding | |
| | Remove food without comment if child loses interest | |
| | Wipe face and clean up only when meal completed | |

## Table 5. Parental and Environmental Factors Associated With Feeding Disorder

| Factor | Result |
|---|---|
| Conditioned aversion | Pairing eating with a painful medical condition or procedure (eg, airway suctioning and intubation) |
| Lack of opportunity | Delayed introduction of breast, bottle, or solids is associated with delayed attainment of appropriate eating skills |
| Positive reinforcement | Caretakers coax or bribe infant who bats away the spoon, turns the head away, or cries |
| Negative reinforcement | Caretakers terminate meal when child acts out |
| Forced feeding | Results in aversion to meals and evokes inappropriate behavior at future meals |
| Overly rigid parents | Undermines child's ability to regulate food intake and impairs child's psychosocial development |
| Chaotic parents | Fail to provide child with appropriate food, support, structure, or opportunity to learn to enjoy a variety of foods or to master eating-related social patterns |

Neither should be diagnosed unless symptoms are of an unusual extent or cause health concerns. (8) (9)

- *Pica disorder*. Pica disorder is the recurring ingestion of nonfood, nonnutritive substances for at least 1 month in a child at least 2 years of age, which is inappropriate to the child's developmental level and sociocultural norms.
- *Rumination disorder*. Rumination disorder is the repeated regurgitation of food for at least 1 month. Regurgitated food may be rechewed, reswallowed, or spit out, most often during or shortly after meals. It is not associated with nausea or a medical condition. It is volitional, distinguishing it from vomiting and gastroesophageal reflux.

### Feeding History

It is important to have caretakers describe the mealtime environment (Table 5) and the child's feeding habits (Table 6).

### Feeding Observation

If time and resources allow, the practitioner or clinic nurse may observe (in person or by video) the child feeding. Such observation allows identification of appropriate child positioning and posture, the child's hunger and satiety cues, the caretaker's response to and interactions with the child, any delayed oral motor or self-feeding skills, and difficulty managing or tolerating liquids or solids (eg, oropharyngeal dysphagia).

A complete physical, neurologic, and oral motor examination must be performed. The oral motor examination includes evaluating facial symmetry, hard and soft palate for (submucous) cleft, and dentition; symmetry and movement of lips and tongue; vocal intensity, pitch, and quality; and cranial nerves. Prolonged inadequate energy and nutrient intake may have broad effects beyond physical growth, with potential effects on psychomotor and neurologic development. It may also affect the immune, skeletal, and cardiovascular systems.

Practitioners should select diagnostic laboratory studies based on the history and physical examination findings. The following are reasonable:

- In cases of failure to thrive: complete blood cell count, urinalysis, blood urea nitrogen, serum electrolytes, and serologic screening for celiac disease (usually IgA antibodies to tissue transglutaminase).
- In cases of pica disorder: serum iron and lead levels.

### Classification of Feeding Disorders

The *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition* (*DSM-5*), informed by available research and extensive discussion of expert clinical experience and opinion, takes a lifespan approach to how age and development affect psychiatric diagnoses. *Avoidant/restrictive food intake disorder* replaces the previous term *feeding disorder of infancy or early childhood* (Table 7). Other classification systems exist; however, none is universally accepted, and few are evidence based.

## Management of Feeding Disorders

The long-term goals of treatment are to improve nutritional status, growth, feeding safety, and quality of life. Recognition and treatment of GERD and constipation are essential. On the basis of findings, practitioners may consult the following:

- A pediatric speech-language pathologist to perform a clinical swallowing evaluation coupled with a video fluoroscopic swallow study to evaluate for oral motor delay and oropharyngeal dysphagia.
- A registered pediatric dietitian to assess caloric intake, nutritional quality, and dietary practices and to comanage enteral feeds.

## Table 6. Components of a Feeding History

| Ask Caretakers | Clinical Significance |
|---|---|
| How they prepare infant formula | Healthy infants require a concentration of 20 kcal/oz, whereas those who have medical problems (eg, cardiac disease) or failure to thrive may require more concentrated or specialized formula |
| Whether they add infant cereal, puréed solids, or proprietary thickeners to formula | Poor tolerance of nonthickened formula may indicate oral motor delay or oropharyngeal dysphagia; premature introduction of solids may reflect cultural practices |
| About food preferences and nutritional deficits (eg, convenience foods, inadequate intake of fruits and vegetables, and excessive juice or milk intake) | May suggest the child's preferences or that caretakers have difficulty setting limits |
| About grazing (eg, overly frequent breastfeeding in older infants; toddlers and older children eating and drinking throughout the day); these children may come to your clinic snacking and drinking. | Grazing may lead to reduced energy intake, increases the risk for dental caries, and suggests caretakers have difficulty setting limits |
| About reliance on dietary supplements (eg, multivitamins, megavitamins, toddler formula, and breakfast drinks) or appetite stimulants (eg, megestrol acetate and cyproheptadine) | Indicates caretaker or practitioner concern and may reveal inappropriate feeding practices |
| About difficulty chewing, excessive drooling, or food or liquid leaving the mouth or nose | Indicates delayed oral motor skills |
| Patient's age at and difficulty with transitions from liquids to purées to solids | May indicate delayed oral motor skills or behavioral preferences |
| Whether child gags, chokes, coughs, or vomits during feeds or has disruptions in breathing, apnea, or cyanosis during feeds | Raises concern for oropharyngeal dysphagia |
| About refusal, tantrums, rumination, pica, avoidance of certain food textures, temperatures, and colors | Identifies maladaptive mealtime behaviors |

- A pediatric gastroenterologist to evaluate severe recalcitrant constipation, GERD, and eosinophilic esophagitis and to comanage enteral feeds.
- A developmental pediatrician to further evaluate for contributing causes (eg, global developmental delay, autism spectrum disorder, and parent-child conflict).
- An interdisciplinary feeding team that includes some combination of the above professionals along with a clinical child and pediatric psychologist.

Oral motor skills usually improve over time but can be promoted in a more organized and efficient manner with therapy. Pediatric speech-language pathologists and occupational therapists generally use noninvasive treatments, such as proper positioning and posture, thickened liquids, modification of bolus size, oral motor and desensitization exercises, specialized nipples and bottles, and altering the temperature, texture, or presentation of food. The evidence base for these interventions is limited. (7) (10) Transcutaneous neuromuscular electrical stimulation is an emerging therapy for dysphagia in children. It involves noninvasive, external electrical stimulation of peripheral motor nerves of the anterior throat to activate the pharyngeal muscles involved in swallowing.

Dietary interventions aim to establish a balanced, healthful diet. Because liquids are usually easier than solids to consume, the tendency is to supplement the diet with toddler formula. Often formulas come to replace meals, leading to grazing and inadequate energy and nutrient intake, further aggravating the child's nutritional deficiency. Clinicians should thus discourage overreliance on toddler formulas and other liquid supplements. Registered dietitians may recommend nutrient- and energy-dense foods and/or specialized formula.

Behavioral feeding therapy is implemented most appropriately in the context of an interdisciplinary team, typically including a registered dietitian, speech-language pathologist, and clinical child and pediatric psychologist. Effective therapy aims to eliminate factors that reinforce maladaptive mealtime behavior. (2) Settings include outpatient, partial day, and inpatient facilities. Treatment should start with the least intrusive approach, generally outpatient. The literature does not support pharmacologic treatment with appetite stimulants (eg, megestrol acetate and cyproheptadine) for behavioral feeding disorders. Caregiver compliance is strongly associated with skills maintenance and generalization.

## Table 7. *DSM-5* Diagnostic Criteria for Avoidant/Restrictive Food Intake Disorder (307.59)

A. An eating or feeding disturbance (eg, apparent lack of interest in eating or food; avoidance based on the sensory characteristics of food; concern about aversive consequences of eating) as manifested by persistent failure to meet appropriate nutritional and/or energy needs associated with one (or more) of the following:
   1. Significant weight loss (or failure to achieve expected weight gain or faltering growth in children)
   2. Significant nutritional deficiency
   3. Dependence on enteral feeding or oral nutritional supplements
   4. Marked interference with psychosocial functioning

B. The disturbance is not better explained by lack of available food or by an associated culturally sanctioned practice.

C. The eating disturbance does not occur exclusively during the course of anorexia nervosa or bulimia nervosa, and there is no evidence of a disturbance in which one's body weight or shape is experienced.

D. The eating disturbance is attributable to a concurrent medical condition or better explained by another mental disorder. When the eating disturbance occurs in the context of another condition or disorder, the severity of the eating disturbance exceeds that routinely associated with the condition or disorder and warrants additional clinical attention.

Reprinted with permission from the American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*. Washington, DC: American Psychiatric Association; 2013.

Those who cannot consume sufficient energy and nutrients or do so safely by mouth require enteral (ie, tube) nutrition. Enteral nutrition can be delivered via nasogastric tube, orogastric tube, or gastrostomy tube (g-tube). For those requiring enteral nutrition for longer than 6 weeks, the latter is preferred. Minimally invasive percutaneous endoscopic gastrostomy and laparoscopic gastrostomy have largely supplanted the open laparotomy for placement of g-tubes. To preserve oral activity and feeding habits, along with hunger and satiety cues, oral feeds (when safe) should precede supplemental tube feeds. Enteral nutrition is delivered either intermittently or continuously. The preferred method is intermittent bolus feedings, which is more physiologic; however, if the patient does not tolerate bolus feeds then continuous feeds, either intragastric or transpyloric (through a gastrojejunostomy), is reasonable. Although the decision to initiate enteral nutrition is emotionally challenging for parents, it eliminates the pressure for oral feeding. It allows the child to be fed safely and efficiently, reducing the risk of aspiration and allowing for catch-up growth. Rapid or voluminous feeds may trigger retching or aggravate GERD. Excessive caloric intake can cause overweight or obesity, leading to problems handling and lifting children who have physical disabilities. Bypassing the oral route deprives the child of the experiences associated with feeding, thus delaying oral sensorimotor skills and increasing the risk for sensory-based food aversions when oral feeds are reintroduced. The earlier in life that a g-tube is placed, the more difficult it becomes to wean the child from it later in life. Finally, continuous feeds are less physiologic than are bolus feeds, resulting in decreased appetite and increasing the risk of grazing and reliance on the g-tube. Tube dependency occurs when the child has the ability to ingest and digest food but cannot be weaned from tube feeding, regardless of medical criteria. For these reasons, children who have g-tubes should be exposed to the mealtime environment, be encouraged to touch and interact with food without regard to intake, be given bolus feeds if tolerated, and have oral feeds advanced when possible. This, along with oral motor and/or behavioral feeding therapy involving the parents, helps the child progress to g-tube independence. Children who receive no feeds, fluids, or flushes through their g-tube for 12 months are candidates to have the device removed. Premature removal may increase the child's risk for complications, such as failure to thrive.

## Summary

- On the basis of strong research evidence, feeding problems and feeding disorders are common, especially in children who have developmental disabilities. (1) (3)
- On the basis of strong research evidence, a variety of prenatal, medical, environmental, behavioral, and parental factors contribute to childhood feeding disorders. (1) (3)
- On the basis of some research evidence plus consensus, many feeding problems are preventable or easily treated.
- On the basis of strong research evidence, left untreated, feeding disorders may result in complications, including aspiration pneumonitis, failure to thrive, and parent-child conflict.
- On the basis of some research evidence plus consensus, treatment of feeding disorders improves nutritional status, growth, feeding safety, and quality of life.

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*(The views expressed are those of the author and do not reflect the official policy or position of the US Air Force, Department of Defense or the US Government.)*

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# Practice Guidelines

## AAP Doubles Recommended Vitamin D Intake in Children

CARRIE ARMSTRONG

*Am Fam Physician.* 2009 Jul 15;80(2):196-198.

Guideline source: American Academy of Pediatrics
Literature search described? No
Evidence rating system used? No
Published source: *Pediatrics*, November 2008 (correction published in January 2009 issue)
Available at: http://pediatrics.aappublications.org/cgi/reprint/122/5/1142

The American Academy of Pediatrics (AAP) has doubled the recommended intake of vitamin D to 400 IU per day for infants, children, and adolescents.

Because levels of sunlight exposure adequate for the cutaneous synthesis of vitamin D may increase the risk of skin cancer, and because natural dietary sources of vitamin D are limited, the new recommendations include all infants, including those who are exclusively breastfed, and older children and adolescents.

Historically, the main source of vitamin D has been via synthesis from cholesterol after exposure to ultraviolet B (UVB) light. Full-body exposure for 10 to 15 minutes during the summer will generate 10,000 to 20,000 IU of vitamin $D_3$ in adults with light skin pigmentation; persons with darker skin pigmentation require five to 10 times more exposure to generate similar amounts. However, many other factors affect the amount of UVB exposure beyond time spent outdoors: the amount of skin pigmentation, body mass, degree of latitude, season, cloud cover, air pollution, amount of skin exposed, and UVB protection (e.g., clothing, sunscreen). Although the AAP encourages physical activity and time spent outdoors, children's activities that minimize sunlight exposure are preferred. However, in following these guidelines, infants, children, and adolescents require vitamin D supplementation.

### Vitamin D Deficiency

New cases of rickets, a preventable condition caused by inadequate vitamin D intake and decreased exposure to sunlight, continue to be reported in the United States. Rickets is characterized by enlargement of the skull, joints of the long bones, and rib cage; curvature of the spine and femurs; and generalized muscle weakness. It is an example of extreme vitamin D deficiency, but deficiency typically occurs months before rickets is obvious on physical examination.

Children with vitamin D deficiency may present with hypocalcemic seizures, growth failure, lethargy, irritability, and a predisposition to respiratory infections during infancy. Clinical effects of vitamin D deficiency include decreased dietary calcium absorption, decreased levels of serum 25-hydroxyvitamin D, and increased levels of parathyroid hormone (in older infants, children, and adolescents). The increase in parathyroid hormone levels causes calcium loss from bones, leading to reduced bone mass and increased risk of fractures.

Serum 25-hydroxyvitamin D concentrations should be at least 20 ng per mL (50 nmol per L) in infants and children.

Based on the most current evidence, vitamin D deficiency in adults is defined as a 25-hydroxyvitamin D concentration of less than 50 nmol per L; vitamin D insufficiency is defined as a concentration of 20 to 32 ng per mL (50 to 80 nmol per L). There is no consensus for these definitions in infants and children, but it has been proven that 200 IU of vitamin D per day will not maintain 25-hydroxyvitamin D concentrations above 50 nmol per L in infants.

## Vitamin D Supplementation

Infants who are exclusively or partially breastfed should receive 400 IU of supplemental vitamin D daily, beginning in the first few days of life. Supplementation should continue until the infant is weaned to at least 1 qt (1 L) of vitamin D–fortified formula or whole milk per day. Infants who are not breastfed, as well as older children who drink less than 1 qt of vitamin D–fortified milk per day, should also receive 400 IU of supplemental vitamin D per day. Other dietary sources of vitamin D (e.g., fatty fish, fortified cereal, egg yolks) may be included in the daily intake. Adolescents who do not obtain 400 IU of vitamin D per day through fortified milk or foods should also receive supplemental vitamin D.

Vitamin D intake of 400 IU per day may be inadequate to prevent deficiency in children at increased risk, such as those with chronic fat malabsorption and those taking long-term antiseizure medications. Higher dosages of vitamin D supplements may be needed in these children, and vitamin D status should be monitored by laboratory tests (e.g., measurement of 25-hydroxyvitamin D, parathyroid hormone, and bone mineral levels).

## "Rice Cereal Can Wait, Let Them Eat Meat First": AAP committee has changes in mind

There is no good reason not to introduce meats, vegetables, and fruits as the first complementary foods, according to Dr. Frank R. Greer, a member of the American Academy of Pediatrics Committee on Nutrition. Introducing these foods early and often promotes healthy eating habits and preferences for these naturally nutrient-rich foods, said Dr. Greer, who is a professor of pediatrics at the University of Wisconsin in Madison.

Rice cereal has traditionally been the first complementary food given to American infants, but "Complementary foods introduced to infants should be based on their nutrient requirements and the nutrient density of foods, not on traditional practices that have no scientific basis," Dr. Greer said in an interview. In fact, the AAP's Committee on Nutrition is working on a statement that will include these new ideas, Dr. Greer said in an interview. Currently, there are no official recommendations for introduction of complementary foods. "There are suggestions of what complementary foods to introduce in various AAP-sponsored publications, which are based on the traditional introduction of solid foods starting with infant iron-fortified cereals and progressing through vegetables and fruits."

Complementary foods are any nutrient-containing solid or liquid foods other than breast milk or formula given to infants, excluding vitamin and mineral supplements. By 6 months of age, human milk becomes insufficient to meet the requirements of an infant for energy, protein, iron, zinc, and some fat-soluble vitamins *(J. Pediatr. Gastroenterol. Nutr. 2008;46:99–110)*.

Rice cereal has been the first complementary food given to infants in the United States for many reasons, including cultural tradition. By the 1960s, most U.S. infants (70%–80%) were fed cereal by 1 month of age. By 1980, rice cereal predominated, as it was considered to be well tolerated and "hypoallergenic"—given growing concerns about food allergies, he said. However, newer thinking is that the emphasis for complementary foods should be on naturally nutrient-rich foods. This includes protein and fiber, along with vitamins A, C, D, and E and the B vitamins. In addition, saturated and trans fats should be limited, as should sugar, said Dr. Greer.

In light of this thinking, rice cereal is a less than perfect choice for the first complementary food given to infants, he said. Rice cereal is low in protein and high in carbohydrates. It is often mixed with varying amounts of breast milk or formula. Although most brands of formula now have added iron, zinc, and vitamins, iron is poorly absorbed—only about 7.8% of intake is incorporated into red blood cells.

In contrast, meat is a rich source of iron, zinc, and arachidonic acid. Consumption of meat, fish, or poultry provides iron in the form of heme and promotes absorption of nonheme iron, noted Dr. Greer. Red meat and dark poultry meat have the greatest concentration of heme iron. Heme iron is absorbed intact into intestinal mucosal cells and is not affected by inhibitors of nonheme iron from the intestinal tract. Iron salts present in infant cereal are generally insoluble and poorly absorbed.

Another issue is when to begin introducing complementary foods, said Dr. Greer. This varies by nationality. In Germany for example, complementary foods are introduced to 16% of infants by 3 months. A third (34%) of infants in Italy and half (51%) of infants in the United Kingdom are introduced to complementary foods by 4 months. In the United States, 18% of infants are introduced to complementary foods—cereal—by 3 months, 40% by 4 mo, 71% by 5 mo, and 81% by 6 mo.

Those complementary food choices for infants aren't always the most nutritious either. By 6 months, roughly a third of U.S. infants have been introduced to fruit (71%) and vegetables (73%), but only 21% have been introduced to meat. In a 2008 study in Pediatrics, researchers reported that 15% of infants have less than one serving of fruit or vegetable per day by 8 months of age (Pediatrics 2008;122[suppl. 2]:S91–7). In contrast, half of 10-month-old infants had eaten at a fast food restaurant, 22% had eaten carryout food, and 28% had eaten restaurant or carryout food at least twice in the previous week.

Early experiences promote healthy eating patterns, said Dr. Greer. It's known that food flavors are transmitted to breast milk; infants whose mothers eat fruits and vegetables during lactation will have greater consumption of fruits and vegetables during childhood *(Public Health Nutr. 2004;7:295–302)*. It's also been shown that infants are more accepting of food after repeated exposure *(Am. J. Clin. Nutr. 2001;73:1080–5)*.

**Don't Avoid or Delay Introducing Allergenic Foods**

Delaying or avoiding the introduction of allergenic foods during a critical window in the first year of life doesn't appear to prevent the development of food allergies and may even put children at increased risk, according to Dr. Greer. There is a lack of evidence to support food allergen avoidance in infants, he said. Any benefits appear to be largely in the first 3–4 months of life, when exclusive breastfeeding is of the greatest benefit for prevention of atopic disease.

Oral tolerance is an antigen-driven process and depends on regular exposure to food antigens during a critical early window. Allergen avoidance may be unsuccessful or detrimental in allergy prevention in infants, he said. There is some evidence that continued breastfeeding during new food introduction is beneficial in preventing atopic disease.

In 2008, the AAP recommended that complementary foods should not be introduced before 4–6 months and noted that there is no indication that delayed introduction of certain foods, including allergenic foods such as wheat, fish, egg, and peanut-containing products, protects against atopic disease *(Pediatrics 2008;121:183–91)*. Likewise, the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) recommended in 2008 that complementary foods should be introduced between 17 and 26 weeks. The group also recommended against the avoidance or late introduction of allergenic foods such as wheat, fish, egg, and peanut *(J. Pediatr. Gastroenterol. Nutr. 2008;46:99–110)*.

Most allergic reactions to foods (90%) are due to eight food types: milk, eggs, peanuts, tree nuts, fish, shellfish, soy, and wheat. However, studies generally have not supported a protective effect for a maternal exclusionary diet during pregnancy; a diet excluding cow's milk, eggs, peanuts, and fish has not been found to protect against the development of atopic disease in infants.

Dietary food allergens, including peanuts, cow's milk protein, and egg, can be detected in breast milk. In the majority of studies, especially those with follow-up beyond 4 years of age, there is no convincing evidence that restricting the maternal diet results in long-term prevention of atopic disease in infants.

# Nutrition II Quiz:

1. Complete this Feeding Chart:

| Age | Foods | Serving Size | Feeding Tips |
|---|---|---|---|
| **0-4 mo** | | | |
| **4-6 mo** | | | |
| **6-8 mo** | | | |
| **8-12 mo** | | | |
| **12-24 mo** | | | |

2. Complete this Formula Comparison Chart:

| Class | Brand Names | Indications |
|---|---|---|
| **Term Formula** | | Appropriate for most infants |
| **Preterm Formula** | Enfamil 24 Premature; Similac 24 Special Care | |
| **Enriched Formula** | | 34-36 wEGA or ready-for-d/c |
| **Soy Formula** | Enfamil Prosobee; Similac Isomil; Good Start Soy | |
| **Hypoallergenic Formula** | | CMPA; *extensively hydrolyzed* |
| **Nonallergenic Formula** | Elecare; Neocate; Nutramigen aa | |

3. **Old School vs. New School:**

Old School: Daily intake of 200IU/day of Vitamin D for all infants, children, & adolescents.

New School: _____

Old School: Start with cereal, then vegetables, then fruits.

New School: _____

Old School: Delay introducing certain foods.

New School: _____

4. How many times must a food be presented before a child will accept it?

# Nutrition II Cases:

**Case 1: Toddler**

A father presents to your clinic with his 2-year old son, Samuel. The family has just moved from Colorado and the chief complaint on your clinic sheet reads "weight concerns". In your chart review, you note that Sam's weight has tracked along the 5-10$^{th}$ percentile for weight, height, and HC since his 2 month checkup.

You reassure the father that his weight pattern is normal, but the father insists that Sam is a "picky eater" and THAT'S why his percentiles are less than average. He says that he and his wife struggle to get Sam to eat ANY vegetable; most fruits are also a struggle. As an example, they have introduced green beans "three or four times" in the past 3 months, but Sam continues to refuse to eat them, which often results in disagreements and tantrums at the dinner table. They usually use dessert as a reward for "cleaning his plate".

**What are nutritional "red flags" in this scenario? What further information would you like from this father?**

You and Sam's father decide to undertake a plan to increase Sam's vegetable consumption.

**What would you recommend in order to get Sam to eat his veggies?**

**What is the maximum amount of juice that Sam should drink in one day?**

**Case 2: Infant**

You are seeing Mrs. Thomas and her now 4 month-old son *(from Nutrition I)*. As you recall, mom is a 24 yo G1P1 who presented with concern for low milk supply, in the context of poor weight gain for her 7 week-old. Over the last 2 mo, she followed all of your recommendations for augmenting her supply: she double-pumped, power-pumped, took Fenugreek, drank Mother's Milk Tea, and tried a 3 week course of Reglan. However, she was unable to produce enough milk to satisfy her son. She presents today for his well-baby check and reports that at 3 mo she gave up breast-feeding, other than "comfort-feeds" at night, and is now formula feeding.

**How do you respond?**

Mrs. Thomas tells you that the switch to formula feeding has not been much easier than her prior attempts at exclusive breastfeeding. She initially started with Similac with Iron, but that made her son "gassy", so she switched to Enfamil with Iron. This caused "diarrhea", so she switched back to Similac with Iron. The "gassiness" did not improve, so she switched to Similac Sensitive — on the recommendation of a co-worker. This formula caused "constipation", so— after reading her favorite "Circle of Moms" Blog— she finally switched to Enfamil Prosobee. She's not quite sure that this formula is working either, plus it is a little more expensive.

**Now, how do you respond?**

After you confirm that the likelihood of an underlying enzyme-deficiency or IgE-mediated allergy (i.e. to milk protein) is low, Mrs. Thomas reluctantly agrees to switch back to Similac term formula. She then asks, **"Well, how much should he be getting and how often?"**

**Does Baby Thomas still need Vitamin D drops now that mom is no longer breastfeeding?**

# Nutrition II Board Review:

1. You are counseling the mother of a 3-month-old breastfed infant whose family has been urging her to introduce cereals to her baby's diet. She asks your advice.

**Of the following, the MOST likely outcome of introducing solid foods at this age is to**
A. accelerate the development of oral-motor skills
B. help the infant sleep through the night
C. increase the risk of food allergies
D. increase the risk of gastroesophageal reflux
E. increase the risk of gastrointestinal infections

2. During a routine health supervision visit, the mother of a 2½ month-old male infant tells you that the baby has been experiencing bloating and flatulence. His diet consists of 5 to 6 oz of a cow milk-based formula given five times per 24 hours. Because of frequent spitting-up, his mother recently added rice cereal to each bottle. He has two to three seedy stools per day. On physical examination, the baby is alert and vigorous. His length and weight are tracking between the 50$^{th}$ and 75th percentiles. The infant's mother asks you whether switching to a soy protein-based formula will help her baby's "gassiness."

**Of the following, the MOST likely the cause of this infant's symptoms is**
A. cow milk protein allergy
B. excessive energy intake
C. incomplete starch digestion
D. lactose malabsorption
E. sucrase-isomaltase deficiency

3. You are addressing a group of new mothers regarding infant feeding. One asks you when an infant can be switched from formula to whole cow milk.

**Of the following, you are MOST likely to respond that whole cow milk**
A. can be introduced at 6 months of age if an infant has significant gastroesophageal reflux
B. can be given at 9 months of age if the infant is also taking a wide variety of supplemental foods
C. may be given as a supplement at any age as long as the infant also receives human milk
D. should be avoided until 12 months of age because its iron content is absorbed poorly
E. should be avoided until 2 years of age because its caloric content is inadequate for optimal growth