

Special Diets

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The role of meeting nutrient requirements in disease, and the importance of providing essential nutrients to prevent disease, have been recognized for centuries. Examples include text from ancient Egyptian writings, the discovery of the dietary etiology of scurvy, and the devotion of Florence Nightingale, the founder of dietetics and modern nursing, to feeding and nursing the sick and wounded during the Crimean War. The concept of diet as an adjunct mechanism to support health and to prevent and treat various disease states has a strong historical foundation.

The term “special diets” refers to diets that are modifications of the normal adequate diet pattern based on the dietary reference intakes suggested by the Food and Nutrition Board of the Institute of Medicine. Modern medical nutrition therapy promotes the use of diet in the prevention and treatment of a variety of diseases.

The majority of healthy children never require special diets. Typically, children thrive on a varied diet with erratic bursts in growth, usually coupled with concomitant changes in appetite. However, many children with chronic diseases require special diets for optimal health, growth, and development. Depending on the condition, the required nutrient adjustments might be acute or chronic. For example, a surgical procedure might necessitate the use of a special diet for a short duration. Other diseases, however, such as insulin dependent diabetes mellitus, phenylketonuria, or celiac disease, require lifelong modifications in nutrient consumption. It is important to recognize that disease is not the only indication for implementation of a special diet. Various situations, including the prevention of unwanted disease, personal religious beliefs, and individual lifestyle preferences, can influence an individual to choose a special diet. In these instances, it is important to evaluate the safety of the special diet for a child.

The rising incidence of obesity in children and the fact that many adults intermittently restrict or alter dietary intake for presumed health effects mean that special or restricted diets may be provided to children more frequently than pediatricians and other clinicians suspect. Therefore, an essential part of the medical history is a review of the diet and eating habits, including timing, consistency, and preparation of meals, as well as the use of dietary supplements.

To implement a medically indicated special diet, adequate education and supervision are key to successful compliance. For children who

require permanent alterations of their diet, regular follow-up, ongoing education, reevaluation of the diet, and continual attempts to motivate the family and maintain the child’s commitment to the diet are important elements of success. Most special diets can be planned to meet 100% of the dietary reference intakes for nutrients; however, some diets could be deficient in particular nutrients and might require vitamin or mineral supplementation. In particular, chronic use of special diets in the pediatric population necessitates periodic monitoring of macro- and micronutrient status. With the proper use of special diets, optimal growth and development can be achieved.

- This chapter describes commonly used special diets for selected pediatric disorders. Chapter 67, “Standard and Specialized Formula,” reviews the rationale and development of types of special formulas, and Appendix III, “Enteral Products,” provides a comprehensive list of commercially available enteral formulas. The conditions and diets described here do not comprise a comprehensive list but rather represent the most common diets required in pediatrics. Special diets for clinical conditions such as food allergy, gastrointestinal disease, growth failure, hyperlipidemia, select inborn errors of metabolism, mineral deficiency, and weight control are found in this chapter. Included are descriptions, rationales for implementation, and lists of specific foods allowed and to be avoided. Checking food labels diligently is strongly advised because manufacturers often change product recipes.

FOOD ALLERGY

Food allergies can require major dietary changes, depending on the food antigen in question. Some of the most common allergens in infancy include cow’s milk protein, soy protein, fish, eggs, and grains. In older pediatric patients, the list expands to include berries, nuts, peanuts, and chocolate. Cow’s milk protein allergy, one of the most common allergies in infancy and early childhood, occurs with a frequency of between 0.5 and 7.0% in the general population. Up to 60% of pediatric patients with immediate hypersensitivity to cow’s milk protein are allergic to soy protein as well.¹

The gold standard for the diagnosis of a potential food allergy is the double-blind placebo-controlled food challenge. Liquid prepa-

rations can be used for infants and toddlers, and tablets or capsules can be used for older children. Such studies should be conducted in a hospital or clinic setting to ensure patient safety, especially in cases of suspected immunoglobulin E (IgE) mediation. Although elimination diets remain popular, they are fraught with problems, including the correct identification of the allergen in question, patient compliance, and other potential agents (dietary or otherwise) that could elicit a similar response.²

Nutritional management includes complete exclusion of the dietary antigen. Families are instructed to read product labels for terms indicative of the antigen, such as whey and sodium caseinate in the case of cow’s milk protein allergy (see “Milk-Free Diet” below for a complete list). For the nonbreastfed infant, a hypoallergenic infant formula is recommended to replace cow’s milk-based formula.³ Fortified soy or rice milk can be substituted for cow’s milk in diets for toddlers. When food allergies are severe or multiple, amino acid-based formulas can be used. Children not receiving a complete enteral supplement should be assessed for mineral and vitamin deficiencies. In families with a high risk for the development of one or more food allergies, it would be prudent to initially breast-feed infants, use a hypoallergenic formula, or both, in conjunction with the avoidance of the common food allergens mentioned.

- Periodic patient education updates are necessary. This is especially important with a diagnosis made in infancy because of the introduction of solid foods and the increased possibility of multiple caregivers. Education for family and even extended family should stress the necessity of continued dietary compliance. Support groups, cookbooks, and the like can be beneficial to patients requiring long-term dietary restrictions.

The Food Allergen Labeling and Consumer Protection Act of 2004 went into effect January 1, 2006.⁴ This law refers to mandatory guidelines for the labeling of foods containing certain food allergens. It refers to all packaged foods sold in the United States that are regulated under the Federal Food, Drug, & Cosmetic Act. It includes domestically manufactured foods as well as imported foods, and excludes meat and poultry products, egg products, and fruits and vegetables in their

natural state. The Food and Drug Administration (FDA) has identified eight major food allergens to which this law applies, which account for 90% of all food allergies: milk, egg, fish, crustacean shellfish, tree nuts, wheat, peanuts, and soybeans. The diets for these major allergens are listed below.

Noteworthy Points

- To comply with the law, labels of food products containing one of the eight major food allergens must either (1) list the ingredient in the ingredient list (eg, “casein (milk)”), or (2) use a “Contains” statement at the end of the ingredient list (eg, “Contains wheat, milk, and soy ingredients”).
- Molluscan shellfish (including oysters, clams, mussels, or scallops) are not included in the list of major food allergens.
- The law does not apply to unintentional cross-contamination of a product with a major food allergen, such as on shared manufacturing lines during processing or cross-contact during harvesting or transporting crops. To ensure a desired food product has not come into contact with a major food allergen, consumers are advised to contact the food manufacturer directly.
- Packages on store shelves which were labeled prior to January 1, 2006 are not required to be in compliance with the above law.
- Because either of two methods can be used to communicate the presence of an allergen, consumers are advised to read food labels carefully before each and every purchase, particularly if your child is allergic to a food which is not considered one of the eight major food allergens.

TREE-NUT-FREE DIET

Tree nuts are available in their natural state (with or without shells), as ingredients in dishes, or processed into butters, flours, oils, pastes, milks, or coffees. The following are tree nuts and should be avoided: acorns, almonds, beechnuts, brazil nuts, cashews, chestnuts, hazelnuts (filberts), hickory nuts, macadamia nuts, pecans (mashuga nuts), pine nuts (pignoli), pistachios, shea nut/shear butter, walnuts, and nut oils or nut butters. During processing, tree nuts can contaminate a food which is not intended to contain a tree nut. Although not mandatory under the new food labeling law, many food manufacturers use voluntary labeling (eg, “may contain peanuts or tree nuts” or “processed on equipment which also processes nuts”). It is important to contact the food manufacturer directly to ensure that a processed food has not unintentionally come into contact with a tree nut.

The following foods may contain tree nuts: baked goods, barbecue sauce, candy, cereals, crackers, ice cream, marzipan, mortadella, natural flavoring, nougat, Nutella (or other chocolate/nut spread), pesto.

Noteworthy Points

- Many African, Chinese, Indonesian, Mexican, Thai, and Vietnamese dishes contain tree nuts.
- Avoid natural extracts such as almond extract, which may contain concentrated amounts of tree nut protein.
- Coconut, nutmeg, and water chestnuts are not in the tree nut family.
- Be aware of lotions and sunscreens which may contain shea butter or other nut butter.
- Experts recommend that if a person is allergic to one tree nut, all tree nuts should be avoided due to risk of cross-contamination.
- Artificial nuts (eg, Nu-Nuts) are in fact ground and reshaped tree nuts, and should be avoided.

CORN-FREE DIET

The corn-free diet is for individuals with an allergy to corn and its derivatives. Elimination of the following ingredients is necessary for individuals adhering to a corn-free diet: corn, corn flour, corn meal, cornstarch, corn sweeteners, corn syrup, corn syrup solids, maize, maltodextrin, marshmallow, popcorn, and powdered sugar.

- The following ingredients might contain corn: hydrolyzed plant protein, hydrolyzed vegetable protein, natural flavors, and starch (99% likelihood of cornstarch content).

EGG-FREE DIET

The egg-free diet is for use in people with a suspected or documented allergic reaction to egg-related products. Elimination of the following ingredients is necessary: egg albumin (also called ovalbumin), eggs, egg white, egg yolk, dried egg, egg powder, egg solids, egg substitutes (which contain eggs), eggnog, egg lecithin, globulin, livetin, lysozyme, mayonnaise, meringue, ovoglobulin, ovomucin, ovomucoid, vitellin, Simplese, and surimi (imitation crabmeat).

Noteworthy Points

- The egg white, or albumin, is the most allergenic part of the egg.
- Many baked products that have a yellow color or shiny glaze are made with eggs or egg whites.
- Egg whites are often used as a clarifying agent in broths or soups. Always check with the chef when eating out.
- Some vaccines are grown on egg embryos and could contain trace amounts of egg protein. Inform your health care provider if your child has an egg allergy.
- Simplese is used as a fat substitute in ice cream and frozen desserts and is made from either egg or milk protein.
- Even if your child is allergic to egg white or egg yolk only, complete egg elimination is recommended. This includes egg in baked goods.

Tips for Egg-Free Cooking

- Egg substitutes can be used only if they are free of egg whites.
- Two tbsp of pureed vegetables can replace an egg in soups, sauces, and other dishes.
- To bind or thicken fruit desserts, use one tsp dry, unflavored gelatin mixed with two tbsp of liquid to replace one egg.
- Because baked goods without eggs crumble easily, use smaller pans. For example, make cupcakes instead of a cake or muffins instead of bread.
- Xanthan gum is excellent for holding baked goods together. Use one tsp for each egg.
- To help leaven baked goods, add an extra half tsp egg-free baking powder for each egg called for in a recipe, along with another egg substitute to bind or thicken.
- For thickening cream dishes and sauces, add extra flour, cornstarch, or xanthan gum.
- To enhance the flavor of egg-free cookies or cakes, add extra ingredients such as raisins, nuts, coconut, seeds, or spices.
- Use any of the following as a binder to replace each egg in your egg-free baked goods:
 - Two tbsp tahini (ground sesame seeds)
 - Two tbsp any nut butter
 - Two tbsp oat flour plus one tbsp water
 - One tsp baking powder, one tbsp liquid (water), and one tbsp vinegar
 - One tsp yeast dissolved in one-fourth cup warm water
 - One and a half tbsp water and one and a half tbsp vegetable oil, and one tsp baking powder
 - Two tbsp mashed banana or apricot puree and half tsp baking powder.

MILK-PROTEIN-FREE DIET

The milk-free diet is for use in patients with a documented, or in some cases suspected, allergy to cow's milk protein. It should not be confused with a lactose-free diet. If the patient is taking a fortified milk substitute, then additional supplements might not be necessary. If a fortified milk substitute is not consumed, the diet could be deficient in calcium, phosphorus, and vitamin D, and supplementation may be needed.

- Elimination of the following ingredients is necessary: artificial butter flavor, butter, butter fat, buttermilk, casein, caseinate (ammonium, calcium, magnesium, potassium, sodium), cheese, cottage cheese, cream, crème fraîche, curds, custard, pudding, ghee, half and half cream, hydrolysates (casein, milk protein, protein, whey, and whey protein), Lactaid milk, lactalbumin, lactoglobulin, lactose, milk (derivative, protein, solids, malted, condensed, evaporated, dry, whole, low fat, nonfat, skim), nondairy creamer (check for casein), nougat, organic milk, raw milk, rennet, sour cream, sour cream solids, whey (delactosed, demineralized, protein concentrate), and yogurt. Ingredients that might indicate the presence of milk proteins are brown

sugar flavoring, caramel flavoring, chocolate, high-protein flour (protein source could be skim milk powder), lactic acid starter culture, margarine (might contain whey), natural flavoring, nondairy creamer (may contain casein), Simplese (could be made from eggs or milk protein), and certain brands of soy yoghurt, soy cheese, or soy desserts.

Noteworthy Points

- Products that have KD or (U)_D on their labels indicate the presence of milk in the product. The ingredient list does not always list the milk source. It could be present as the result of cross-contamination from a milk-containing product that is produced in the same facility. Some labels now state “KDE,” which indicates that the product is kosher but made on dairy equipment.
- Parve or Pareve on the label indicates that the product may be milk free; check all labels to confirm.
- Certain vitamin and mineral supplements, as well as some prescription and over-the-counter drugs, contain lactose as a filler. Consult a doctor or pharmacist for specific information.
- The brine that surrounds prepackaged deli meats often contains whey or casein. There could also be cross-contamination from other meat or cheese products when meats are sliced in a store’s deli area.
- Some brands of canned tuna fish contain casein.
- Goat’s milk and sheep’s milk are not acceptable cow’s milk substitutes.

Suggested Milk-Free Foods

Fats. Kosher margarine, unsalted Mazola margarine, unsalted Fleishmann’s stick margarine, lard, vegetable oil, mayonnaise, cocoa butter, Better than Cream Cheese (Tofutti brand), Sour Supreme (Tofutti brand).

Fruits. All types.

Meat, Fish, Poultry, and Eggs. Plain beef, poultry, fish, pork, lamb, bacon, kosher frankfurters, kosher cold cuts (eg, Morrison & Schiff or Hebrew National), tofu, peanut butter, eggs.

Cheese. Soy cheese (without sodium caseinate).

Potatoes, Pasta, and Rice. All except prepackaged (canned or frozen) products, in which casein is added to pasta to maintain shape.

Soups. Clear canned soups and commercial and homemade soups made with allowed ingredients. Be sure to check labels as even some clear soups might contain margarine, which will probably contain milk products.

Beverages. Milk-free infant formulas such as Isomil, ProSobee, and Alsoy; fruit juices; carbonated beverages; Kool-Aid; cocoa without added milk solids; Nut Quick (Ener-G Foods); Westbrae Rice Drink, Amazake Original, Rice Dream; soy milks such as EdenSoy Original, Vitasoy Original, Vitasoy Light Original, and WestSoy Lite Plain.

Bread and Crackers. French, Italian, Vienna, or Syrian bread; bagels are traditionally milk-free but check labels.

Cereals. Most do not contain milk products in the ingredient list but often have the (U)_D symbol, which suggests that the product could contain some milk and should be avoided.

Sweets. Sugar, jams, jellies, syrups, honey, candies such as gum drops, baking chocolate, Marshmallow Fluff.

Desserts. Jello, fruit sorbet, Italian ice (gelato), milk-free Popsicles; baked products made with Crisco, Spry, or allowed margarine; Royal brand instant pudding mix made with appropriate milk substitute; milk-free cake mixes (read labels); Tofutti.

Vegetables. All types.

Miscellaneous. Mustard, relish, ketchup, salt, pepper, spices, soy sauce, cocoa powder, carob powder, potato chips, pretzels (check labels for (U)_D), olives, peanut butter without added milk, plain popcorn, corn chips.

PEANUT-FREE DIET

The peanut-free diet is for individuals with a known peanut allergy. The peanut is a legume and not a member of the nut family. Legumes are edible seeds enclosed in pods; others include soybeans, lima beans, carob, and sweet clover. Peanut allergy can be fatal.

- Elimination of the following ingredients is necessary: cold-pressed peanut oil, ground nuts, mixed nuts, peanuts, peanut butter, peanut flour, and nut meats. Foods that could contain peanuts or peanut products include African, Chinese, Indonesian, and Thai dishes; baked goods (eg, pastries, cookies); beer nuts; candy; chili and spaghetti sauce (which might be thickened with peanut butter); chocolate candies; egg rolls (may be sealed with peanut butter); hydrolyzed plant protein; hydrolyzed vegetable protein; ice cream; marzipan (which can be a mixture of nuts); and nougat.

Noteworthy Points

- Peanut allergies are usually not outgrown.
- Skin tests for peanut allergy are positive throughout life.
- Only peanut oil prepared by the hot-solvent extraction processes that are commonly used in the United States is known to be free of protein.⁵ However, as not all peanut oils are produced in the same way, caution may warrant complete avoidance of peanut oil.
- Check all candy labels; often they will list peanuts on the label if the product was made in the same facility as another peanut-containing candy. For example, plain M&Ms and Raisinettes both note on the label that they may contain peanuts, but peanuts are not necessarily in the ingredient list.

- Avoid mixed nuts, which often contain peanuts.
- Some kitchens use peanuts in a variety of foods, which makes cross-contamination in restaurants likely.
- Egg rolls are occasionally sealed with peanut butter.
- Avoid crafts which call for peanut butter.

SHELLFISH-FREE DIET

The shellfish-free diet is for individuals with a documented allergy to shellfish. Individuals allergic to one type of shellfish could be allergic to others in the same family. Edible shellfish are usually divided into two categories: mollusks and crustaceans. Mollusks, such as clams and mussels, have two shells, but also include the abalone, which has a shell covering and a soft underpart. The crustaceans, such as the lobster, have segmented bodies that are covered with an armor-like section of thick and thin shells.

Elimination of the following ingredients is necessary: mollusks, such as abalone, calamari, clams, cockle, escargots/snails, mollusk, mussels, octopus, oysters, periwinkle, sea urchin, scallops, and squid, and crustaceans, such as crab, crawfish, crayfish, ecrevisse, lobster, shrimp, prawn, and crevette.

Caution should be exercised at salad bars, where cross-contamination may occur, as well as restaurants with deep fryers shared with shellfish.

SOY-FREE DIET

The soy-free diet is for patients with a documented, or in some cases suspected, soy protein allergy. Patients with a soy protein allergy rarely have difficulty meeting their macro- and micro-nutrient requirements. However, patients with both cow’s milk and soy protein allergies should be monitored for caloric and protein (quality and quantity) intakes, as well as for calcium, phosphorus, and vitamin D intakes. If possible, supplementation with a fortified milk-free, soy-free formula will assist in meeting nutrient requirements for growth.

- Elimination of the following ingredients is necessary: edamame, hydrolyzed soy protein, miso, natto, shoyu sauce, soy beans, soy cheese, soy fiber, soy flour, soy grits, soy milk, soy nut butter, soy nuts, soy protein concentrate, soy protein isolate, soy sauce, soy sprouts, soy yoghurt, soya, tempeh, textured vegetable protein, tofu, and yuba. The following ingredients might indicate the presence of soy protein: flavoring, hydrolyzed vegetable protein, hydrolyzed plant protein, natural flavoring, vegetable broth, vegetable gum, and vegetable starch.

Noteworthy Point

Most people with soy allergies can safely eat soy lecithin and soy oil. Soy lecithin, often used as a stabilizer, emulsifier, or an antioxidant, is a

mixture of fatty substances and is a by-product of soybean processing. The processing of most soybean oils removes the protein portion.

Suggested Soy-Free Foods

Beverages. Milk, fruit juices, carbonated beverages, Kool-Aid, cocoa, hot chocolate; infant formulas such as Enfamil, Similac, Nutramigen, Alimentum, and Pregestimil; rice beverages such as Rice Dream and Westbrae Rice Drink.

Bread and Crackers. Syrian and French bread.

Cereals. Oatmeal, cream of rice, cream of wheat; any cold cereals with allowed ingredients; infant cereals without soy (check labels).

Fats. Butter, cream, bacon, soy-free mayonnaise, lard, pure vegetable oil (eg, coconut, corn, cottonseed, olive, peanut, safflower, sunflower).

Meat, Fish, Poultry, Cheese, and Eggs. All types when plain or prepared with allowed ingredients, such as waterpacked tuna; kosher 100% beef hot dogs; eggs; all cheese except soy cheese and imitation cheeses containing soy.

Meat Alternatives. Legumes (eg, baked beans), nuts, and seeds, except soybeans.

Potatoes, Rice, and Pasta. All, including spaghetti, macaroni, and plain noodles.

Vegetables. All except soybeans.

Fruits. All fruit and fruit juices.

Soups. Homemade and canned soups made with allowed ingredients.

Desserts. Fruit, gelatin, homemade puddings (cornstarch, tapioca, rice); ice cream, sherbet, and fruit ices; Popsicles, Fudgsicles; homemade cakes, cookies, and pies made with allowed ingredients; baking chocolate; yogurt.

Sweets. Sugar, jams, jellies, honey, molasses, syrups, marshmallows.

Miscellaneous. Salt, pepper, spices, mustard, relish, ketchup, pickles, olives, coconut; snack foods only if prepared without soy (potato chips, popcorn, dry roasted peanuts).

WHEAT-FREE DIET

The wheat-free diet is for patients with a documented, or in some cases suspected, wheat allergy. The following ingredients should be eliminated from the diet: bread crumbs, bran, bulgur, cereal extract, cous-cous, cracker meal, durum flour, enriched flour, farina, flour, gluten, graham flour, high-gluten flour, high-protein flour, malt vital gluten, matzo, semolina, triticale, wheat bran, wheat grain, wheat gluten, wheat starch, and whole-wheat flour. The following ingredients could have wheat present: gelatinized starch, hot dogs, hydrolyzed vegetable protein, ice cream, imitation crabmeat, modified food starch, natural flavoring, sauces (could be thick-

ened with wheat), soy sauce, starch, vegetable gum, and vegetable starch.

Noteworthy Points

- One and one-eighth cup oat flour, seven-eighth cup rice flour, or one cup yellow/white corn flour can be substituted for one cup wheat flour.
- Spaghetti squash, corn pasta, and rice pasta make great substitutions for regular pasta.
- Fresh, frozen, and canned vegetables are your best choice. Prepackaged vegetables in sauces often contain wheat as fillers.
- Gluten free also means wheat free.
- For thickening, instead of one tbsp wheat flour, use half tbsp cornstarch.
- The white, all-purpose flour which is often used for baking is wheat flour.

Suggested Wheat-Free Foods

Beverages. Milk, fruit juices, carbonated beverages, Kool-Aid, cocoa, hot chocolate.

Breads and Crackers. Only those made with 100% rye, oat, corn, or rice flour with no wheat added; corn tortillas.

Cereals. Any corn, oat, rice, or rye cereal that has no wheat flour added (eg, puffed rice, corn flakes, crispy rice).

Potatoes, Rice, and Pasta. All plain rice and wheat-free pastas.

Fats. Butter, margarine, vegetable oils, lard, bacon, cream, mayonnaise, homemade gravy thickened with cornstarch.

Meat, Fish, Poultry, Eggs, and Cheese. All types when plain or prepared with allowed ingredients; all eggs; all cheeses. Be sure to read the labels of processed cheeses.

Meat Alternatives. Legumes, nuts, seeds (eg, peanut butter, baked beans, tofu).

Vegetables. All types; avoid those prepared with sauces.

Soups. Homemade soups with allowed ingredients.

Desserts. Fruit, gelatin, junket, cornstarch, and tapioca puddings.

Miscellaneous. Salt, pepper, spices, mustard, ketchup, pickles, relish, olives, coconut, baking chocolate, potato chips, corn chips, popcorn.

ALLERGY ORGANIZATIONS, SUPPORT GROUPS, AND RESOURCES

- Food Allergy and Anaphylaxis Network, 11,781 Lee Jackson Highway, Suite 160 Fairfax, VA 22033-3309; telephone: 800-929-4040; fax: 703-691-2713; e-mail: faan@foodallergy.org; www.foodallergy.org. The Food Allergy and Anaphylaxis Network (FAAN) is a national nonprofit organization

established to help families living with food allergies and to increase public awareness about food allergies and anaphylaxis. All resources are checked for medical accuracy by FAAN's Medical Advisory Board. There is a subscription fee.

- American Academy of Allergy, Asthma, and Immunology, 800-822-ASMA (2762), www.aaaai.org
- American Academy of Pediatrics, 800-433-9016, www.aap.org
- American College of Allergy, Asthma, and Immunology, 800-842-7777, www.acaai.org
- Asthma and Allergy Foundation of America, 800-7-ASTHMA (727-8462), www.aafa.org
- American Dietetic Association, 800-366-1655, www.eatright.org
- www.peanutallergy.com

GASTROINTESTINAL DISEASES

A number of gastrointestinal diseases require dietary modification, both short- and long-term. Patients can have malabsorption, maldigestion, or both coupled with an inadequate intake, as seen in both celiac disease and Crohn's disease, for example. Patients often require individually tailored diets based on their degree of bowel integrity or function. Enteral formulas, both standard and special, are commonly used with several gastrointestinal disorders (see Appendix III, "Enteral Products"). In addition, Chapter 67, "Standard and Specialized Formula," reviews the rationale and development of many of these formulas. Below, we review the more common diets used in pediatric gastroenterology. Please refer to other chapters for a more detailed discussion of each disorder.

FAT MODIFICATION FOR PANCREATIC DISEASE

A low-fat diet might be indicated in the treatment of chronic pancreatitis, as well as the later stages of acute pancreatitis. Acute pancreatitis usually warrants the discontinuation of oral feedings. As clinical parameters indicate improvement of the disease state, careful reintroduction of food might be allowed, with the eventual return to a normal diet.

Chronic pancreatitis with pancreatic enzyme insufficiency will necessitate enzyme replacement therapy; however, dietary modification is usually not necessary. Children with chronic pancreatitis and pancreatic enzyme sufficiency can consume a diet containing 20 to 30% of calories from fat, unless laboratory and clinical data suggest fat intolerance.

Low-fat diets are based on individual requirements and must be designed by using food tables, reading labels, and following the Food Guide Pyramid; they also must be evaluated for tolerance and acceptance. Caloric consumption should be carefully monitored whenever fat restriction is warranted. Fat restriction to less than 5% of total

Table 1 Dietary Fiber Content of Foods

Food	Little (<0.5 g)	Low (1 g)	Moderate (2 g)	High (3 g)	Very High (>4 g)
Dairy	Milk, yogurt, pudding, ice cream, cheese	–	–	–	–
Protein	Eggs, beef, chicken, pork, turkey, fish	–	2 tbsp peanut butter	1/2 cup garbanzo beans, lima beans	1/2 cup lentils (5 g), northern beans (4 g), navy beans (5 g), pork and beans (6 g), kidney beans (6 g)
Fruit	Fruit juice, watermelon, cherries	1/2 cup canned pears, pineapple, fruit cocktail, peaches, fresh grapes	Fresh: 1 peach, 3 apricots, half a grapefruit; 1/2 cup applesauce, blueberries, strawberries	Fresh: 1 apple, orange, banana, 3 dates; 1/2 cup raspberries; peaches, apricots, apples	Fresh: 1 pear (5 g), half an avocado (4 g), 3 plums (4 g), dried: 1/4 cup raisins, 3 prunes (4 g)
Vegetables	–	1/2 cup tomato, juice lettuce, spinach, celery, cauliflower, cucumber, green beans	1/2 cup tomato, cabbage	1/2 cup sweet potato, broccoli, carrots, peas, potato salad, corn	1 baked potato with skin (4 g)
Breads	1 slice French, Italian, raisin, or white bread; 1 pancake or donut; half a bagel	1 slice cracked wheat, bread; 1 tortilla or whole-wheat pancake	1 slice 100% whole-pumpernickel, or rye	1 slice Branola; wheat bread	1 slice flourless bread (5 g), 1 bran muffin
Cereals	1/2 cup corn flakes, Frosted Flakes, Lucky Charms, Cheerios	1/2 cup oatmeal, Life, Total, Honey Nut Shredded Wheat	1/2 cup shredded wheat, Nutrigrain, Wheaties, n' Raisins, Wheat Chex	1/2 cup Bran Flakes, granola, Crispy Wheats, wheat germ	1/2 cup 100% bran (9 g), Raisin Bran, Grape Nuts, All Bran, (9 g), Fiber 1 (12 g); 1/4 cup unprocessed wheat bran (7 g; 2 g/tbsp)
Pasta and rice	1/2 cup white pasta	1/2 cup egg noodles, white rice	1/2 cup brown rice	–	1/2 cup whole wheat pasta
Crackers	Goldfish, saltines, Ritz	2 graham, 16 Wheat Thins, 1 granola bar	3 Harvest Wheats, 3 Triscuit	1 rye crisp	Metamucil wafers
Desserts	Chocolate chip cookies	Oatmeal cookies	Fig Newtons, Peak Freans, Bran Crunch (3 g)	–	–
Miscellaneous	Beverages, fats, sweets	–	1 cup popcorn	1/4 cup cashews, pecans, peanuts, walnuts	1/4 cup almonds, 1/4 cup coconut

Adapted from reference 6.

daily calories places the child at risk for the development of essential fatty acid deficiency.

- For specific foods pertaining to the low-fat diet, see “Low Cholesterol and Low Saturated Fat Diet” below.

HIGH-FIBER DIET

Dietary fiber is a food component that is neither digested nor absorbed by the body. This undigested material can itself absorb water, resulting in the formation of larger, softer stools, which are more easily moved through the intestines and then passed. A high-fiber diet can benefit the whole family. Diets high in fiber have been shown to control constipation, lower the risk of colon cancer, and reduce blood cholesterol levels. Children are more accepting of dietary changes when they are adopted by the entire family.

- A general rule of thumb for recommended daily fiber intake is five plus the age (in years) of the child more than 2 years of age, to a maximum of 35 g/d. For example, a 7 years old should receive 12 g/d (5 + 7 years).

Noteworthy Points

To increase the fiber content in a child's diet, include fruits, vegetables, and whole grains (Table 1).

During commercial processing, the fiber content of these sources can be reduced. Therefore:

- Instead of white bread, use 100% whole-grain breads.
- Instead of processed cereals, use whole-grain cereals.
- Instead of canned fruits and juices, use fresh fruits.
- Maintain a well-balanced diet: choose a variety of foods from the Food Guide Pyramid (see Appendix II, “Nutritional Requirements”).
- Increase fiber in the diet gradually. A sudden increase in dietary fiber intake can cause gas and bloating.
- If a child refuses high-fiber foods, remember that children often need to be introduced to foods several times before the foods become familiar and acceptable. Slow changes in a child's diet are often better accepted than rapid ones.
- Increase fluid intake with an increase in dietary fiber (Table 2). Inadequate fluid intake can also cause constipation.
- Give children choices as to what they would like to eat but provide appropriate choices.
- Add two to four tbsp of a high-fiber cereal to a favorite hot or cold cereal.
- Add unprocessed wheat bran to yogurt, apple-sauce, hot or cold cereal, soup, peanut butter, tuna salad, pancake batter, or spaghetti.

GLUTEN-RESTRICTED DIET

The gluten-restricted diet is necessary, for life, for patients diagnosed with celiac disease. The diet is designed to provide adequate nourishment while eliminating foods containing the gliadin fraction of gluten, a protein found in many grains, which causes intestinal injury in susceptible people. Although many cereal grains contain gluten, only wheat, rye, barley, and oats contain the gliadin fraction. Gliadin from these grains is present in many everyday foods, including breads, rolls, crackers, cookies, and breakfast cereals, and might also be present as an incidental ingredient in food additives and derivatives (see the list below). For

Table 2 Recommended Fluid Intake

Child's Weight (lb)	Total Fluid Per 24 h (Cups)
7	2
12	3½
21	5
26	6
35	7
44	8
63	9½
99	10½

this reason, food labels must be read carefully. When all sources of gliadin are removed from the diet, the intestine will heal and function normally.

Noteworthy Points

- Despite the restrictions, the gluten-restricted diet should be well balanced based on the Food Guide Pyramid. Table 3

lists foods allowed and restricted while following a gluten-restricted diet. Table 4 provides sample menus for a gluten-restricted diet.

- Read food labels carefully to avoid gluten-containing grains and gluten derivatives such as
 - Flour and cereal products: avoid textured vegetable protein

- Colorings: avoid hydrolyzed vegetable protein
- Emulsifiers: avoid hydrolyzed plant protein
- Flavorings: avoid starch
- Malt or malt flavoring: avoid modified food starch
- Preservatives: avoid vegetable gum
- Vinegar: avoid distilled white or grain vinegar.

Table 3 Gluten-Restricted Diet

Type of Food	Allowed	Avoid
Grains and flours	Arrowroot starch, corn flour, cornstarch, cornmeal; maize and waxy maize; potato flour, potato starch flour; rice bran; rice flours: plain, sweet, brown, and polished rice; soy flour; tapioca starch	Low-gluten flours; all flours containing wheat, rye, barley, and oats; durum wheat, all purpose flour, white enriched flour, wheat germ, whole-wheat flour, wheat starch; wheat bran; oat bran; amaranth; buckwheat, buckwheat groats; bulgar; graham; kasha; matzo; millet; rusks, semolina, sorghum; triticale
Breads	Specially prepared breads using only allowed flours (100% potato, corn, rice, arrowroot, soybean); special commercial gluten-free baking mixes (Ener-G Foods, Dietary Specialties)	All breads, rolls, etc, made with wheat, rye, barley, or oats
Cereals	Hot or cold cereals made from corn meal, rice, hominy*	All containing wheat, rye, barley, oats, farina, bran (except rice bran), graham, wheat germ, kasha, bulgar, buckwheat, millet, triticale. Do not eat cereals that contain malt unless the source is known.
Noodles and pasta	Gluten-free corn pasta; special gluten-free pasta (Aproten and other brands); oriental rice noodles or bean noodles	Regular noodles, spaghetti, macaroni, etc
Crackers and snacks	Pure cornmeal tortillas; rice wafers; rice cakes without added rye or millet;* popcorn; crackers made with allowed flours (100% potato, corn, rice, arrowroot, soybean); some potato chips*	All containing wheat, wheat snack foods, starch, rye, barley, oats, bran (except rice bran), graham, wheat germ, malt, kasha, bulgar, buckwheat, matzo, millet, durum wheat, sorghum, rusks, amaranth, triticale
Milk products	Fresh, dry, evaporated, or condensed milk; cream; sour cream;† whipping cream,† yogurt†	Malted milk; commercially prepared milkshakes; some nondairy cream;* some commercial chocolate drinks*
Meat and alternatives	Fresh meat, fish, poultry, and eggs; fish canned in oil, brine, or water; luncheon meats, frankfurters, and prepared meat products packaged without food starch or gluten derivatives; peanut	Any meat or meat products containing wheat, rye, barley, oats, or gluten derivatives; some canned tuna in vegetable broth,* some sausages,* frankfurters, luncheon meats, and sandwich spreads; canned chili and stews; bread-containing products such as Swiss steak, pot pies, croquettes; selfbasting turkey with hydrolyzed vegetable protein (HPV) injected as part of the basting solution
Cheese	Aged cheese (100% cheddar, Swiss, parmesan, etc); cottage cheese,† cream cheese; processed cheese*	Cheese foods; cheese spreads or dips; imitation cheese products
Fruit and juices	Most fresh, frozen, dried, or canned fruit	Thickened or prepared fruits as in pie fillings*
Vegetables	Most plain, fresh, frozen, or canned vegetables; dried beans, peas, and lentils; tomato puree and paste; white and sweet potatoes; yams; hominy; rice	Vegetables in sauces;* commercially prepared vegetables; canned baked beans; most packaged rice mixes
Fats	Most margarines,* butter, vegetable oil, lard, shortening; nuts; pure mayonnaise made without distilled white vinegar*	Commercial salad dressings and dips,* unless product contents are known
Sweets and desserts	Special commercial gluten-free cakes, cookies, and baking mixes; homemade puddings with cornstarch, rice, or tapioca; some pudding mixes,* gelatin desserts, custards, and ices; sherbet and ice cream if they do not contain gluten stabilizers,* hard candy flavored with sugar, honey, molasses, marshmallow, coconut, or chocolate; most jams and jellies;* most nonbuttered syrups;* some candy*	Most commercially prepared cakes, cookies, and other baked goods; “instant” puddings and bread pudding; ice cream cones; frozen desserts containing gluten stabilizers; check contents of commercial candies
Beverages	Fruit juice; plain tea; brewed coffee; hot chocolate made with pure cocoa powder; carbonated drinks except most root beers; wine and brandy without dyes or preservatives; most rums; vodka distilled from potatoes	“Instant” drinks, such as tea, coffee, cocoa, and fruit punch, which are processed with additives, stabilizers, or emulsifiers;* ground coffee with added grain; some flavored coffees;* some herbal teas;* most root beers;* all beer and ale; all whisky (including corn whisky); bourbon; any liquor made from grain alcohol; vodka distilled from grain
Soups	Homemade broths and soups made with allowed ingredients; special gluten-free commercial soups (Ener-G Foods)	Most canned soups and soup mixes,* bouillon, bouillon cubes or powder
Miscellaneous	Cider, rice, or wine vinegar; salt; black or red pepper; herbs; pure spices; monosodium glutamate (MSG); bicarbonate of soda; pure cocoa; most yeast; baking powder; cream of tartar; flavoring if not made with alcohol (choose imitation)	Distilled white vinegar; most white pepper; some curry powder;* some dry seasoning mixes (such as chili seasoning mix);* some gravy extracts and meat sauces;* yeast flakes;* extracts,* natural flavorings containing alcohol; ketchup,* prepared mustard, and horseradish

Commercially prepared condiments (pickles, ketchup, mustard, mayonnaise, steak sauce) are usually made with distilled white vinegar, which is made with grain.

A very small amount of protein may be carried over into white vinegar during distillation. Moderate use of commercially prepared condiments is allowed by some physicians. However, individuals with newly diagnosed or extreme gluten sensitivity should avoid these condiments.

*Some products may be used if checked with the manufacturer and found to be gluten free.

†Check label for oat gum.

Table 4 Sample Menus for a Gluten-Restricted Diet

Breakfast	Lunch	Dinner	Snack
Orange juice, scrambled egg, gluten-free muffin with margarine, milk	Corn pasta with tomato and meat sauce, fresh fruit, milk	Tossed salad with gluten-free dressing, grilled chicken, rice, ice cream (check label), milk	Potato chips, fruit juice
Grape juice, gluten-free waffles with strawberries or gluten-free syrup, milk	Tacos (pure corn tortilla, beef, cheese, tomato), mixed fruit cup, milk	Oven-fried whitefish (gluten-free beans, cornflake crumbs), french fries, carrot coins, pudding (check label)	Milk, gluten-free pound cake
Apple juice, hot rice cereal, gluten-free toast, milk, margarine, jelly	Grilled cheese on gluten-free bread, fresh fruit, gelatin, milk	Baked pork chop, potatoes, corn, applesauce, gluten-free cookies	Peanuts and raisins

Table 5 Additives and Ingredients to Avoid on Gluten-Free Diet

Additives*	Modified starch*
Alcohol*	Mono- and diglycerides*
Amaranth	Oat
Barley	Oat groats
Bran*	Oatmeal
Buckwheat	Oat gum
Buckwheat groats	Preservatives*
Bulgur	Rye
Cereal products*	Rusks
Coloring*	Semolina
Distilled white vinegar	Sorghum
Durum wheat	Stabilizers*
Emulsifiers*	Starch*
Farina	Textured vegetable protein (TVP)*
Flavorings*	Triticale
Flour*	Vegetable gum*
Groats	Vegetable protein*
Hydrolyzed plant protein (HPP)*	Wheat
Hydrolyzed vegetable protein (HVP)*	Wheat flour
Kasha	Wheat germ
Malt flavoring	Wheat germ oil
Matzo cake meal	Wheat starch
Matzo farfel	White enriched flour
Matzo meal	Whole-wheat flour
Millet	Wheat stabilizers
Modified food starch*	

*Some products can be used if the manufacturer verifies that they are gluten free.

- Product ingredients can change from one batch to another. To check an ingredient, contact the Celiac Sprue Association/USA, the Gluten Intolerance Group of North America, or the manufacturer of the product. Foods of unknown composition should be omitted. Brand names of gluten-free products are available from the celiac sprue support groups. Table 5 provides a list of additives and ingredients to avoid while

following a gluten-free diet; Table 6 lists those that are permitted.

- Many gluten-free foods can be purchased at grocery stores, Asian food markets, and health food stores.
- Eating in restaurants requires planning and a basic knowledge of foods and food preparation. Choose foods prepared simply, such as broiled or roasted meats, plain vegetables, plain salads, and foods without breading, gravies, or sauces.
- A lactose-restricted diet might be necessary in the early treatment of newly diagnosed celiac disease if symptoms of malabsorption are severe. Milk and milk products may be restricted and gradually reintroduced into the diet.
- Ensure prescription and nonprescription medications are gluten-free.
- Use a separate colander and toaster for gluten-free pasta and breads.

Tips For Gluten-Restricted Cooking

Gluten's elasticity is an important element in baked products. Special recipes to compensate for this are required when gluten-free flours are used for baking. Cookbooks specifically for the gluten-restricted diet are available. When gluten-free flour or starch is used as a substitute in baked goods, it is necessary to increase the amount of leavening (baking powder, baking soda, yeast, or eggs) and protein (eggs, milk or powdered milk, soy flour, tofu, or cottage cheese). A mixture of flours gives a better result in gluten-free baking.

The following grains can also be used in the quantities listed as a substitute for one cup of wheat flour:

- Five-eighth cup potato starch flour (half cup plus two tbsp)
- Seven-eighth cup white rice flour (three-fourth cup plus two tbsp)

Table 6 Additives and Ingredients Allowed on Gluten-Free Diet

Adipic acid	Mannitol
Ascorbic acid	Microcrystalline cellulose
BHA	Monosodium glutamate (MSG)
BHT	Niacin
Betacarotene	Polyglycerol
Biotin	Polysorbate 60 and 80
Calcium phosphate	Potassium citrate
Calcium chloride	Potassium iodide
Calcium pantothenate	Propylene glycol monostearate
Carboxymethylcellulose	Propylgallate
Carrageenan	Pyridoxine
Citric acid	hydrochloride
Corn sweetener	Riboflavin
Corn syrup solids	Sodium acid pyrophosphate
Demineralized whey	Sodium ascorbate (ascorbic acid)
Dextrimaltose	Sodium benzoate
Dextrose (dextrins)	Sodium caseinate
Diocetyl sodium sulfosuccinate	Sodium citrate
Folic acid (folacin)	Sodium hexametaphosphate
Fructose	Sodium nitrate
Fumaric acid	Sodium silicoaluminate
Gums: acacia, arabic, carob bean, cellulose, guar, locust bean, tragacanth, xanthan	Sorbitol
Invert sugar	Sucrose
Lactic acid	Sulfosuccinate
Lactose	Tartaric acid
Lecithin	Thiamine
Magnesium hydroxide	hydrochloride
Malic acid	Tricalcium phosphate
	Vanillin
	Vitamins and minerals
	Vitamin A (palmitate)

Adapted from reference 7.

- Half cup soy flour plus half cup potato starch flour
- One cup corn flour
- One cup fine cornmeal
- Three-fourth cup coarse cornmeal.

To substitute for one tbsp of wheat flour as a thickener in sauces, gravies, and puddings, use one of the following:

- Half tbsp cornstarch
- Half tbsp potato starch
- Five and half tsp white rice flour
- Five and half tsp arrowroot starch
- Two tsp quick-cooking tapioca.

Celiac Disease Organizations, Support Groups, and Resources

Support groups provide a network for people with celiac disease. Group services provide up-to-date information about celiac disease and the gluten-free diet, and include information and referrals, publications, such as newsletters and gluten free diet instructions, annual conferences, and workshops.

National groups include:

- Celiac Sprue Association/United States of America, Inc. (CSA/USA), PO Box 31700, Omaha, NE 68131-0700; telephone: 877-CSA-4CSA; fax: 402-558-1347; www.csaceliacs.org
- Canadian Celiac Association National Office, 5170 Dixie Rd., Ste. 204, Mississauga, ON L4W 1E3; telephone: 800-363-7296; fax: 905-507-4673; www.celiac.ca
- Gluten Intolerance Group of North America (GIG), 31,214 124 Avenue SE, Auburn, WA 98092; telephone: 206-246-6652; fax: 206-246-6531; www.gluten.net
- Celiac Disease Foundation, 13251 Ventura Blvd., Ste. 3, Studio City, CA 91604; telephone: 818-990-2354; fax: 818-990-2379; www.celiac.org
- Celiac Support Group; <http://www.childrenshospital.org/clinicalservices/Site2166/mainpageS2166P0.html>
- Organizations that can be of assistance in following the gluten-free diet include; www.celiac.com
- American Dietetic Association, National Center for Nutrition and Dietetics; telephone: 800-366-1655 (consumer hotline); www.eatright.org
- US FDA, www.fda.gov

LACTOSE-FREE DIET

The lactose-free diet is intended for the individual who must eliminate sources of lactose from the diet, such as patients with galactosemia (an inborn error of metabolism) or those who have difficulty digesting lactose.

Lactose is the primary carbohydrate of dairy products; therefore, foods containing milk or milk products are to be excluded from the diet. People with lactose intolerance might not produce enough intestinal lactase to break down the lactose in their diet. The undigested lactose can cause symptoms such as gas, abdominal pain, diarrhea, and poor weight gain. Table 7 outlines the foods that are permitted and those that should be avoided while following the lactose-free diet.

Noteworthy Points

This diet is not intended for those who are sensitive to cow's milk protein. Read labels carefully. Avoid any food containing milk, nonfat milk solids, skim milk, butter, cream, lactose, casein, caseinate, sodium caseinate, or whey.

Calcium Supplements

If a nutritionally complete lactose-free infant formula, enteral product, or nutritional supplement is taken, this diet can be sufficient in all nutrients. If a lactose-free fortified milk substitute is not consumed, the diet could be deficient in calcium, phosphorus, and vitamin D. If a milk-free diet is followed for more than 4 to 6 weeks, calcium and other vitamin or mineral supplementation might

Table 7 Lactose-Free Diet

Foods Allowed	Foods to Avoid
Milk: none	All milk, milk drinks—including whole, skim, low-fat, dried, evaporated, and condensed milk, breast milk; yogurt (any type, cream or sour)
Soy protein infant formulas	Infant formulas other than those permitted, frappes, ice cream sodas
Fortified soy or rice milk	An enzymatic preparation such as LactAid may be added to milk to convert lactose into digestible sugars; instructions are for conversion of 70 to 95% of the lactose to glucose and galactose; check with your nutritionist or physician before beginning use of LactAid
Eggs: as desired	Eggs prepared with milk—use specific formula; do not prepare with butter
Meats: any except those to be avoided	Creamed or breaded meat, fish, or poultry; prepared meats that contain dried milk solids including bologna and cold cuts, frankfurt, salami, commercially prepared fish sticks, and some sausage; kosher products are milk free
Beverages: powdered, fruit-flavored drinks, ginger ale, tonics	Any made with milk, such as frappes, eggnog, hot chocolate
Cheese: soy or lactose-free cheeses	All types of cheeses and cheese dishes that are not listed as allowed
Breads: breads made without milk, such as French bread, Italian bread, water bagels, or parve breads	Any baked products made with milk; muffins, biscuits, waffles, pancakes, donuts, sweet rolls, commercial mixes
Cereal: any made without milk, cooked or ready to eat. Macaroni, spaghetti, pasta, rice—all prepared without milk	Any prepared cereal that contains dry milk solids
Vegetables and potatoes: all cooked, canned, frozen, or fresh	Any vegetable prepared with milk, butter, milk solids, bread, or bread crumbs; no cheese or cream sauces
Fruit: all	
Desserts: any made without milk or milk products, such as gelatin desserts, fruit crisp, snow puddings, fruit and water sherbets, pie with fruit filling, angel food cake	All commercial cake and cookie mixes, ice cream, custard puddings, junket, ice milk or sherbets that contain milk; frosting made with milk or butter, dessert sauces, cheese cakes
Soup: any prepared without milk or milk products; homemade or canned (eg, chicken rice)	All creamed soups, chowders; no cheese
Fats: milk-free margarine or parve margarine; oils, nuts, peanut butter	Butter, margarine, some commercial salad dressings
Sugar and seasonings: sugar, honey, molasses, maple syrup, corn syrup, jelly and jam, hard candy, gum drops, marshmallow, hard peppermints, fondant; salt, pepper, spices, herbs, condiments, vinegar, ketchup, relish, pickles, olives, tomato sauce, coconut, wheat germ; artificial flavoring or extracts	Any product made from milk, butter, cream, chocolate, toffee, cream mints, caramel candy, candy with cream centers
Miscellaneous	Medications that use lactose as filler or bulk agents; party dips, nonprescription vitamins; spice blends; Easter egg dyes; dietetic foods and foods advertised as high protein sometimes contain lactose or dry milk solids

Adapted from reference 8.

be needed. Choose a supplement that is complete, well absorbed, and cost efficient. Calcium supplements are available in several acceptable forms: carbonate, gluconate, lactate, and citrate. Avoid dolomite or bonemeal supplements because they have been linked with lead poisoning.

Low-Lactose Diet Guidelines

These guidelines are intended for individuals who can tolerate small amounts of lactose or those who are reintroducing lactose after following the lactose-free diet. Note that a lactose containing diet is not appropriate for persons with galactosemia.

Some foods that contain lactose might be better tolerated than others owing to natural processing. Examples are naturally aged cheeses and yogurt with live cultures.

After a period of lactose-free intake, the reintroduction of lactose into the diet should be gradual, based on individual tolerance. Better tolerance might be achieved by consuming lactose-containing foods in small amounts. There are products available that are designed to aid in the digestion of lactose. Lactase enzymes are commercially available as chewable tablets and drops. Refer to Table 7 for further information about lactose-containing foods.

GROWTH FAILURE

Growth failure and failure to thrive are terms that describe the condition of infants, children, and young adults whose physical growth deviates significantly from standards or falters from their individual growth pattern. Growth failure can be a result of a variety of factors, including medical, social, and psychological conditions. In most cases, these factors create an environment in which caloric intake is inadequate to meet requirements for normal growth and development (see Chapter 43, “Failure to Thrive: Malnutrition in the Pediatric Outpatient Setting,” for more details).

- Nutritional management is the cornerstone of therapy for individuals afflicted with growth failure. Therapy should aim to reverse nutrient deficits, achieve ideal body weight for height, and restore optimal body composition. Diets rich in calories and adequate in protein facilitate reversal of growth failure and failure to thrive. The following section provides guidelines for increasing the caloric content of the diet and outlines sample foods and meal plans designed to promote a high-calorie intake with adequate protein.

HIGH-CALORIE DIET

The high-calorie diet is indicated for promoting weight gain or preventing excessive weight loss during periods of increased nutritional needs (eg, infectious or postoperative states). A well-balanced diet based on the Food Guide Pyramid with an emphasis on foods that are high in protein and calories should be followed.

Suggestions for Increasing Calories and Nutrient Density Milk and Milk Products

- Use high-calorie milk (recipe follows) or half-and-half cream as a beverage and as a substitute for milk or water in cooking whenever possible (pudding, cocoa, milkshakes, cream soup, custard, eggnog).
- Add powdered milk to yogurt, casseroles, bread, muffins, sauces, and gravies.
- Melt cheese on sandwiches, meats, potatoes, vegetables, rice, pasta, and cream sauces; add cheese to salads.
- Have cream cheese or cottage cheese on crackers or added to vegetables or pasta.
- Make Instant Breakfast with whole or high-calorie milk.
- Add whole-milk yogurt to fruit or desserts and use as a topping for cereal, pancakes, and waffles.

Protein Group

- Add small pieces of cooked meat, fish, poultry, or eggs to salads, casseroles, soups, vegetables, omelets, and noodles.
- Use peanut butter (or other nut butter) with all grain products, spread on fruit or vegetables, or blended in milk drinks, ice cream, or yogurt.

- Add nuts to desserts, salads, ice cream, vegetables, or fruits (nuts are not recommended for children under three years of age).
- Add textured vegetable protein or legumes to casseroles or soups.
- Offer simple fried foods such as chicken or fish.
- Serve meat with extra gravy or sauce when appropriate.

Fruits and Vegetables

- Add mashed fruit to milk, yogurt, shakes, ice cream, and pudding.
- Add dried fruits to muffins, cookies, cereal, and grains or combine with vegetables and nuts (children under 3 years of age can be at increased risk for choking with dried fruits and nuts).
- Serve vegetables raw with a dip, cooked cream style, or topped with melted cheese.
- Add butter, sour cream, or mayonnaise to vegetables.

Grains

- Make hot cereals with milk instead of water.
- Use high-protein noodles and grains in casseroles and soups.
- Coat meat with breading or flour before cooking.
- Top muffins, toast, crackers, and pancakes with margarine, cream cheese, syrup, jam, peanut butter, cheese, or honey (honey is not recommended for children under 1 year of age).
- Serve granola over ice cream, frozen yogurt, or fruit or mixed with nuts or dried fruit.

Tips for Increasing Caloric Intake

- Eat small, frequent meals throughout the day.
- Keep snacks handy for nibbling.
- Try eating a snack or drinking a high-calorie beverage before going to bed in addition to other meals.
- Instead of drinking water, select beverages that contain calories, such as high-calorie milk or frappes (see recipes).
- Notice the times of day that appetite is best and eat more at those times.

Sample Meal Plan

The following daily food plan is one example of a high-calorie diet:

Breakfast

Half cup citrus juice

One protein serving (eg, one egg, one-fourth cup cottage cheese, two tbsp peanut butter, 1 oz cheese, or 1 oz meat)

Two servings of whole-grain bread products or enriched cereal margarine, butter, jam, jelly, sugar

One cup high-calorie milk (recipe follows)

Morning Snack

Frappe (recipe follows)

Lunch

Three to four ounces of protein

Half cup vegetable

Two servings whole grain, potato, rice, or other starch

One serving fruit or dessert

Butter, margarine, jelly, sugar

One cup high-calorie milk

Afternoon Snack

Frappe or high-calorie milk

Peanut butter or cheese with crackers or as a sandwich

Dinner

Three to four ounces of protein

Two servings vegetable (one deep-green or yellow vegetable)

Two servings whole grain, potato, rice, or other starch

One serving fruit or dessert

Margarine, butter, jelly, sugar

One cup high-calorie milk

Evening Snack

Frappe or high-calorie milk

Pizza, grilled cheese sandwich, or pudding

Recipes

The following recipes are revised from those developed by clinical nutrition staff at Children’s Hospital Boston.

Fortified Milk (180 to 210 cal)

Add two to four tbsp of powdered nonfat dry milk to 8 oz of whole milk

Vanilla Shake/Frappe (400 cal)

Five and half cups ice cream (three to four scoops)

Half cup whole milk

Three tbsp nonfat milk powder (Can also add two tbsp of strawberry, chocolate, or coffee syrup)

Mix in blender

Strawberry Shake/Frappe (530 cal/8 oz)

Two cups whole milk

Two-third cup nonfat dry milk powder or one pkg of Carnation Instant Breakfast

Ten and a half cups strawberry ice cream

Two tbsp heavy cream

Mix in blender

Creamsicle Shake/Frappe (560 cal)

Half cup whole milk

Two tbsp instant nonfat dry milk powder

Half cup orange juice

One cup orange sherbet

One pkg of vanilla Instant Breakfast

Mix in blender

Peanut Butter Shake/Frappe (400 cal)

One cup whole milk

Three tbsp smooth peanut butter

Three tbsp chocolate syrup

Mix in blender

Banana Orange Shake/Frappe (690 to 790 cal)

Half cup milk

Half cup orange juice

One cup vanilla ice cream

Two whole bananas

Mix in blender

Super Pudding (326 cal)

One cup fortified milk

One cup heavy cream

One pkg (20.5 oz) instant pudding

Make into half cup servings.

Super Grilled Cheese

Dip cheese sandwich into egg fortified milk mixture before grilling with lots of butter or margarine. This will be like French toast with cheese in the middle.

CONGENITAL HEART DISEASE AND HYPERLIPIDEMIA

Pediatric patients with congenital heart disease or hyperlipidemia require careful nutritional monitoring to ensure optimal growth and devel-

opment. Growth failure in congenital heart disease is common and can be attributable to anorexia, hypermetabolism, frequent respiratory infections, decreased peripheral blood flow, malabsorption, or pulmonary hypertension, among other factors.^{9,10} Patients requiring dietary fat restriction because of hyperlipidemia are placed at greater risk for caloric deficits, as well as deficits in calcium and iron. Nutrition education with frequent monitoring is necessary to prevent these deficiencies.

- Fluid-restricted and sodium-restricted diets are often used in the management of congenital heart disease.

Table 8 Sodium-Restricted Diet

Type of Food	Allowed	Avoid
Meat, fish, fowl, and cheese	Fresh or frozen beef, lamb, pork, rabbit, veal, chicken, turkey, liver; fresh fish except shellfish, canned salt-free tuna; salt-free cottage cheese; eggs (one per day); salt-free peanut butter	Smoked, processed, or canned meat or fish; frankfurters, ham, sausage, pepperoni, Spam, bacon, luncheon meat, salt-free chipped or corned beef, salted kosher meats, salt pork, smoked tongue, canned tuna or salmon, caviar, salted and dried cod, herring, frozen fish fillets; frozen meat pies, frozen entrees; shellfish: clams, crabs, lobsters, oysters, scallops, shrimp; egg substitutes; cheese (unless low sodium); peanut butter (unless low sodium); anchovies
Breads and cereals	Low-sodium breads, cereals, and cereal products; breads and mixes; rolls made without salt; quick breads made with sodium-free baking powder or potassium bicarbonate and without salt; the following cooked cereals without added salt: pearl barley, cracked wheat, plain farina, Ralston, maltex rolled oats, pettjohns, wheatena, rice; dry cereals: puffed rice, puffed wheat, shredded wheat; macaroni, spaghetti, noodles (cooked without added salt); salt-free melba toast, salt-free venus wafers, low-sodium crackers, plain, unsalted matzo, yeast waffles	Breads and rolls made with salt or commercial mixes; quick breads (pancakes, waffles, cakes, pastries, muffins) made from baking powder, baking soda, salt, monosodium glutamate or commercial mixes; quick cooking and enriched cereals that contain a sodium compound (read label); dry cereals (except those allowed); crackers (except low sodium); "self-rising" flour or cornmeal
Fruits and juices	All fresh; frozen, canned, or dried to which salt, sodium benzoate, or sodium sulfite has not been added; read labels	Regular tomato and vegetable juices, maraschino cherries; any fruit or fruit product that contains salt or sodium benzoates, sodium-preserved dried fruits
Vegetables	Fresh, frozen, or dietetic canned without salt: asparagus, green beans, dried lima beans, dried navy beans, brussels sprouts, cabbage, cauliflower, corn, cowpeas, cucumbers, parsley, parsnips, peas (fresh), peppers, potatoes, sweet potatoes, pumpkin, radishes, rutabaga, soybeans, squash (winter, summer), tomatoes, turnip greens	All regular canned vegetables; beets, beet greens, carrots, celery, dandelion greens, hominy, kale, mustard greens, pickles, sauerkraut, spinach, white turnips, frozen peas or lima beans if processed with salt; commercially seasoned frozen vegetables, frozen mixed vegetables
Desserts	Fruit and fruit juices as allowed above; gelatin (made with plain, unflavored gelatin, sugar, fruit and fruit juices); homemade cornstarch, rice, or tapioca pudding made from part of milk allowance or low-sodium milk; ice cream; candy, cake, cookies, pastry: homemade, salt free, or special low sodium	Commercial candies, cakes, cookies, or homemade unless prepared with allowed ingredients; packaged pudding, Jello or other commercial sweetened gelatin desserts
Fat	Lard, vegetable oil, shortening, salt-free butter or margarine, unsalted nuts	Salted butter or margarine, bacon fat, salt pork, commercial mayonnaise or other salad dressing (except low sodium), salted nuts, olives
Sugar and sweets	Sugar, honey, syrups, jams, marmalades, and jellies that contain no preservatives	Molasses, commercial jams containing sodium benzoate or other sodium preservatives (read labels)
Beverages	Fruit juices, lemonade, milk (regular or low sodium as allowed), coffee, tea, Postum, Hershey's cocoa (made with allowed milk or water)	Fountain beverages, "Dutch process" cocoa, instant cocoa mixes, powdered milk, prepared beverages, mixes including fruit-flavored powders, mineral waters, buttermilk
Seasonings and condiments	All spices, extracts, herbs, except those with sodium as an ingredient; lemon juice, vinegar, salt substitute (with doctor's approval), low-sodium bouillon cube	Salt; celery salt, seeds, and flakes; onion salt, garlic salt, prepared mustard, ketchup, horseradish prepared with salt, barbecue sauce, chili sauce; meat extracts, gravies, and tenderizers; monosodium glutamate (Accent), soy sauce, Worcestershire sauce, saccharin and other sugar substitutes containing salt, regular bouillon cubes, olives, relishes, pickles. Avoid all foods with above seasonings added
Miscellaneous		Canned, dehydrated, or frozen potato; spaghetti, macaroni, or noodle products; preprepared gravies; canned or dehydrated soups, except low sodium; salted popcorn, potato chips, pretzels, and other snack items such as corn chips or Doritos; party spreads and dips; regular baking powder, baking soda (sodium bicarbonate), rennet tablets, laxatives, Chinese/Asian food, Italian food, fast foods, bread stuffing

FLUID-RESTRICTED DIET

The fluid-restricted diet is a modification of the normal diet in which all fluids are limited to a prescribed level. Individuals with renal, liver, or cardiac insufficiency might require it.

Noteworthy Points

- All foods contain water in varying amounts. All foods that are liquid at room temperature are considered to be fluids. These include water, tonic, coffee, tea, fruit and vegetable juices, milk, ice, ice cream, sherbet, Popsicles, fruit ices, gelatins, soups, gravies, sauces, cream, and alcohol.
- Fluid from solid foods is not routinely restricted in a fluid-restricted diet. Solid foods with the highest water content are fruits and vegetables. Excessive consumption of these foods should be avoided.
- Liquid medications and fluids consumed while ingesting medications must be accounted for in the fluid-restricted diet.
- The following measurements are useful in calculating daily fluid allowance:
 - 1 oz = 30 cc = two tbsp
 - 4 oz = 120 cc = half cup
 - 8 oz = 240 cc = one cup
 - 32 oz = 960 cc = four cups = 1 quart
 - 1 L = 1,000 cc = 1 kg

SODIUM-RESTRICTED DIET

The sodium-restricted diet is a modification of the normal diet in which the sodium content is limited to a prescribed level. Many people consume much more than the recommended amount (adequate intake) of sodium. Conditions that might require sodium restriction include hypertension, congestive heart failure, liver disease, renal disease, and corticosteroid therapy. If a strict sodium restriction is necessary, see Table 8 for lists of foods allowed and to avoid. For children, a no added salt diet might be a sufficient restriction.

Suggestions for Limiting Sodium Intake

- Do not use salt in cooking and do not add salt to food at the table. Do not put the saltshaker on the table.
- Read labels carefully on all canned, frozen, and packaged foods. Avoid products with

added sodium or salt. Ingredients are listed on the package by weight, from the largest amount to the smallest.

- Use low-sodium or sodium-free canned soups, broth, potato chips, crackers, and nuts.
- Try spices and flavorings such as herbs, onion powder, thyme, or lemon juice to add flavor to foods.
- Limit fast foods and restaurant foods that are high in sodium. Most restaurant meals can be made without added salt or salt-containing ingredients such as monosodium glutamate or soy sauce.
- Evaluate medications for sodium content because some medicines contain sodium. Examples are laxatives (Ex-Lax), antacids (Maalox), and some pain relievers, such as acetaminophen (Tylenol).

LOW-CHOLESTEROL AND LOW-SATURATED FAT DIET

Cardiovascular disease is associated with a variety of risk factors, including hypercholesterolemia. Blood cholesterol levels can be reduced by as much as 10 to 15% by lowering cholesterol and saturated fat consumption. Exercise, in conjunction with dietary modifications, should be encouraged as this can aid in lowering cholesterol, as well as in weight management.

- Low-cholesterol and low-saturated fat diets are used for the management of hypercholesterolemia. The American Heart Association released new dietary guidelines in June 2006 which replaced the Step One and Step Two diets.¹¹ These new guidelines emphasize the crucial relationship between nutrition and exercise in the prevention and treatment of cardiovascular disease, and encourage a further reduction in saturated and *trans* fatty acid intakes. These dietary recommendations are only for children 2 years of age and older because of the rate of central nervous system development at an earlier age. An earlier report discusses specific recommendations for children less than 2 years of age.¹² Because of the potential risk of insufficient caloric intake, careful monitoring is necessary to ensure normal growth and development in all children on these diets. Table 9 provides target nutrient intake levels to optimize cardiovascular health and promote optimal growth. Table 10 discusses dietary guidelines for hyperlipidemia.

Definition of Dietary Fats

There are four types of fat in the food we eat: saturated fat, polyunsaturated fat, monounsaturated fat, and *trans* fat. Saturated fats are believed to increase blood cholesterol, so the amount of saturated fat in the diet should be limited. Saturated fat is usually solid at room temperature. Examples are butter, shortening, meat fats (suet, lard, salt pork, bacon fat), chicken fat, coconut oil, palm oil, and hydrogenated oils. The fat in whole milk, cheese, yogurt, and cream is also saturated.

- Polyunsaturated fats lower total blood cholesterol, that is, both low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol. Polyunsaturated fat is liquid at room temperature. Examples are corn, safflower, sunflower, soybean, cottonseed, walnut, and sesame oils, as well as fish, which contains omega-3 polyunsaturated fats. Mono-unsaturated fat lowers serum LDL while maintaining HDL levels. Examples are olive, canola, and peanut oils, as well as some other nut oils. *Trans* fats are formed when liquid oils are hydrogenated into a solid form. They are found in margarine, cookies, crackers, pastries, baked goods, and many other processed foods and snack foods. Evidence suggests that *trans* fats raise LDL and lower HDL levels. The *trans* fat content of all processed foods is mandatory on US food labels as of January 1, 2006.

Suggestions for Lowering Cholesterol and Saturated Fat Intake

- Limit red meat to a maximum of two or three servings (2 to 3 oz per serving) per week. Use only lean cuts of meat. Cut away any visible fat from meat before cooking.
 - Bake, broil, boil, or stir-fry meats, fish, or poultry. Remove skin from poultry.
 - Use nonstick fry pans or nonstick spray coatings.
 - Eat no more than three or four egg yolks per week. Substitute two egg whites for a whole egg in recipes. Use egg whites to batter meats and vegetables, coat with crumbs moistened with acceptable oil, and then bake. Use low-cholesterol commercial egg substitutes in place of whole eggs.
 - Read labels of commercially prepared products and avoid those containing ingredients not allowed.
 - Limit all fats and oils to reduce total fat intake.
 - Avoid fast foods that could be high in fat (eg, fried chicken, french fries).
 - Increase fish intake, especially oily fish, to two servings per week.
 - Try some meatless dishes, such as pasta with tomato sauce or vegetarian stir-fry dishes.
 - Use high-protein vegetables such as legumes (kidney, red, or pinto beans) and fat-free dairy products to supply protein.
 - Limit high-calorie sauces such as cream, cheese, and Alfredo sauce.
 - Achieve 60 minutes of moderate to vigorous play or exercise every day.
 - Choose whole grains and cereals rather than refined grains.
 - Eat skim or low-fat dairy products daily.
- To reduce high triglyceride levels, take the following steps to decrease simple carbohydrate intake (if LDL is also high, it will be necessary to also reduce saturated fat intake):
- Avoid sweetened drinks such as soda, fruit juices, and coffee beverages; replace with water, skim or 1% milk, or smoothies made with fat- and sugar-free yogurt and fresh fruit.

Table 9 AHA Diet Recommendations for Lowering Cardiovascular Disease Risk

Nutrient	Recommended Intake
Total fat	25 to 35% of total calories
Saturated fat	<7% of energy
<i>Trans</i> fat	1% of energy
Cholesterol	<300 mg/d
Sodium	<2.3 g/d
Fiber	Minimum 14 g/1,000 kcal

Adapted from references 11 and 12.

Table 10 Diet for Hyperlipidemia

Food Group	Choose	Decrease
Fats and oils	Unsaturated oils—safflower, sunflower, corn, soybean, cotton seed, canola, olive, peanut Margarine made from unsaturated oils listed above; light or diet margarine Salad dressings made with unsaturated oils listed above; low fat or oil free Seeds and nuts—peanut butter, other nut butters Cocoa powder	Coconut oil, palm kernel oil, palm oil Butter, lard, shortening, bacon fat Dressings made with egg yolk, cheese, sour cream, whole milk Coconut Chocolate
Breads and cereals	Breads—whole-grain bread, hamburger and hot dog bun, corn tortilla Cereals—oat, wheat, corn, multigrain Pasta Rice Dry beans and peas Crackers—low-fat animal type, graham, saltine type Homemade baked goods using unsaturated oil, skim or 1% milk, and egg substitute—quick breads, biscuits, cornbread muffins, bran muffins, pancakes, waffles	Bread in which eggs are a major ingredient, croissants Granola made with coconut Egg noodles and pasta containing egg yolk High-fat crackers Commercial baked pastries, muffins, biscuits
Soup	Chicken or beef noodle, minestrone, tomato, vegetarian, potato	Soup containing whole milk, cream, meat fat, poultry skin
Vegetables	Fresh, frozen, or canned	Vegetables prepared with butter, cheese, or cream sauce
Fruits	Fruit—fresh, frozen, canned, or dried Fruit juice—fresh, frozen, or canned	Fried fruit or fruit served with butter or cream sauce
Sweets and modified fat desserts	Beverages—fruit-flavored drinks, lemonade, fruit punch Sweets—sugar, syrup, honey, jam, preserves, candy made without fat (candy corn, gumdrops, hard candy), fruit-flavored gelatin Frozen desserts—sherbet, sorbet, fruit ice, popsicles Cookies, cake, pie, pudding—prepared with egg whites, egg substitute, skim or 1% milk, and unsaturated oil or margarine; gingersnaps; fig bar cookies, angel food cake	Candy made with chocolate, coconut oil, palm kernel oil, palm oil Ice cream and frozen treats made with ice cream Commercial baked pies, cakes, donuts, high-fat cookies, cream pies
Meat, poultry, and fish	Beef, pork, lamb—lean cuts well trimmed before cooking Poultry without skin Fish, shellfish Processed meat—prepared from lean meat (eg, turkey ham, tuna wieners)	Beef, pork, lamb—regular ground beef, fatty cuts, spare ribs, organ meats, sausage, regular luncheon meats, wieners, bacon Poultry with skin, fried chicken Fried fish, fried shellfish Regular luncheon meat (eg, bologna, salami, sausage, wieners)
Eggs	Egg whites (two whites equal one whole egg in recipes), cholesterol-free egg substitute	Egg yolks; includes egg used in cooking
Dairy products	Milk—skim or 1% fat (fluid, powdered, evaporated), buttermilk Yogurt—nonfat or low-fat yogurt or yogurt beverages Cheese—low-fat natural or processed cheese (part-skim mozzarella, ricotta) Cottage cheese—low fat, nonfat, or dry curd (0 to 2% fat) Frozen dairy dessert—ice milk, frozen yogurt (low fat or nonfat)	Whole milk (fluid, evaporated, condensed), 2% low-fat milk, imitation milk Whole-milk yogurt, whole-milk yogurt beverages Regular cheeses (American, blue, Brie, cheddar, Colby, Edam, Monterey Jack, whole-milk mozzarella, Parmesan, Swiss), cream cheese, Neufchatel cheese Cottage cheese (4% fat) Ice cream, cream, half and half, whipping cream, nondairy creamer, whipped topping, sour cream

- Avoid large or frequent servings of sugary foods such as cookies, candy, ice cream, fruit rollups, and regular chewing gum.

To determine how many calories come from fat in a particular product, using the information on the food label, divide the calories coming from fat by the total calories and then multiply by 100. This equals the percentage of calories from fat. If the percentage from fat is less than 30%, the product is appropriate; if it is more than 30%, the product is too high in fat. The goal is to balance any high-fat food with low-fat foods so that at the end of the day, total fat intake is 25 to 35% of calories.

Determining Percentage of Calories From Fat: An Example

Product: Cheez-it

Serving size: 12 crackers (nutrition information is per serving)

Calories: 70; calories from fat: 36

Protein: 2 g

Carbohydrates: 7 g

Fat: 4 g (total fat per serving)

Polyunsaturated fat: less than 1 g

Saturated fat: 1 mg

Cholesterol: less than 2 mg

Sodium: 135 mg

Ingredients: enriched flour, riboflavin, vegetable shortening (contains one or more of the following: partially hydrogenated oils: soybean, cottonseed, canola), skim milk, cheese, salt, paprika, yeast, paprika extractives (vegetable color). (Ingredients are listed in descending order, with the largest amount first.)

- Thirty-six calories from fat divided by 70 cal per serving = $0.51 \times 100 = 51$; therefore, 51% of calories are from fat. This product is high in fat.

INBORN ERRORS OF METABOLISM

Medical nutritional therapy plays a key role in the management of several metabolic disorders, including those related to carbohydrate, fatty acid, and amino acid metabolism.¹³ Dietary alterations are often necessary in reestablishing a balance in metabolic function through provision of deficient products and restriction of toxic substrates. In addition, nutritional management is important in stabilizing altered protein enzymes, replacing cofactors that might be deficient, and supplying products that are deficient owing to an inhibited secondary pathway.

Several formulas currently available for the management of metabolic disorders are age and diagnosis specific (see Appendix III, “Enteral Products”). Frequent monitoring is imperative to ensure optimal growth and neurologic development in these medically complex patients.

Appendix III, “Enteral Products” provides an extensive list of known metabolic disorders and their suggested dietary modifications, including appropriate enteral formulas.

MINERAL-RICH DIETS

A number of acute and chronic pediatric medical conditions might require mineral supplementation, either in the diet or by therapeutic measures during their course. Included in this list is cow’s milk protein allergy, lactose intolerance, hypercholesterolemia, renal disease, and celiac disease. Some diets chosen for personal reasons, such as the vegan or lacto-ovo-vegetarian diets, can be inadequate in certain micronutrients.

- Included in this section are lists of food sources high in calcium and iron, the minerals most commonly found to be deficient in the pediatric population. It is recommended that any child on a special diet be assessed for micro- and macronutrient intake periodically to ensure an optimal intake for growth and development.

CALCIUM-RICH DIET

A calcium-rich diet is recommended for all individuals as part of a healthful, well-balanced diet. In particular, growing children have high dietary requirements for calcium. Consuming calcium-rich foods daily will help minimize resorption of calcium from the bones and thus promote dense, strong bones.

Milk and dairy products are the primary source of calcium in the North American diet; the other food groups—breads, meats, fruits, and vegetables (include calcium-fortified juices)—provide the remainder (see Appendix II “Nutritional Requirements,” for Dietary Reference Intakes and Table 11 for calcium food sources).

Calcium Information

- Dietary Reference Intakes, National Academy Press: www.nap.edu.
- Pennington JAT. *Bowes and Church’s Food Values of Portions Commonly Used*, 17th edition. Philadelphia: Lippincott-Raven Publishers; 1997.
- National Dairy Council: www.nationaldairycouncil.org.

IRON-RICH DIET

The iron-rich diet might be indicated for individuals with anemia. Anemia can occur as a result of dietary deficiencies, blood loss, or inadequate absorption of iron.

The body more readily absorbs iron from animal sources (heme iron) than from vegetable sources (nonheme iron). Consuming foods high in vitamin C at the same meal can enhance the absorp-

Table 11 Calcium Food Sources

Food Group	Calcium/ Serving (mg)	Food Group	Calcium/ Serving (mg)
Milk and dairy		English muffin	105
Milks, 1 cup	300	Waffles (7")	179
Buttermilk	285	Wonder calcium rich bread (white/whole wheat), 1 slice	290
Chocolate	280	Wonder light calcium enriched bread, 2 slices	290
MalTED	347	Vegetables/legumes (1/2 cup cooked)	
Whole	291	Beet greens	82
1% low fat	300	Bokchoy	79
2% low fat	297	Broccoli	89
Skim	302	Butternut squash	42
Soy Plus-West Soy (soy milk)	300	Cabbage	79
Cheeses	77 to 337	Carrots	35
American, pasteurized process, 1 oz	174	Collards	74
Blue, 1 oz	150	Kale	90
Brick, 1 oz	191	Lima beans	35
Caraway, 1 oz	191	Mustard greens	38
Cheddar, 1 oz	191	Okra	50
Cheese food		Pumpkin	31
American, pasteurized process, 1 oz	163	Stewed tomatoes	42
Swiss, pasteurized process, 1 oz	205	Spinach	61
Colby, 1 oz	194	Sweet potatoes	38
Cottage, 2% low fat, 1/2 cup	77	Tomato soup	80
Edam, 1 oz	207	Tomato soup, with milk (1 cup)	159
Monterey, 1 oz	212	Turnip greens	99
Mozzarella, part skim, 1 oz	207	Fruits/juices	
Whole, 1 oz	147	Rhubarb, 1/2 cup	174
Muenster, 1 oz	203	Dried figs, 1/2 cup	144
Ricotta, part skim, 1/2 cup	337	Orange	92
Whole, 1/2 cup	257	Orange juice (calcium fortified) 8 oz	300
Swiss, 1 oz	272	Dates, dried cut, 1/2 cup	53
Frozen desserts, 1/2 cup	88 to 104	Prunes, dried, (4)	49
Ice cream, 1/2 cup	88	Hawaiian Punch (calcium fortified), 8 oz	150
Ice milk, hardened, 1/2 cup	88	Cereal (1 cup)	
Ice milk, soft serve, 1/2 cup	88	Total	282
Sherbet, 1 cup	51	Total raisin bran	200
Frozen yogurt, 1/2 cup nonfat	104	Total corn flakes	200
Yogurt low fat, 1 cup	345 to 415	Basic four	200
Flavored	389	100% Natural	181
Fruit	345	Oatmeal	170
Plain	415	Life	154
Pudding, 1/2 cup	150	Other	
Protein		Molasses blackstrap, 1 tbsp	137
Beans, dried, cooked, 1 cup	90	Carnation breakfast bar, 1 each	500
Clams, 4 oz	100	Combination and fast foods	
Crab, 3 oz	132	Pizza Hut supreme personal pan pizza	520
Cod, 3 oz	136	Lasagna (2½" × 2½")	460
Halibut, 3 oz	191	Macaroni and cheese, homemade (1 cup)	362
Oysters, raw, 1/2 cup	113	Enchilada, cheese (1 enchilada)	324
Perch, 3 oz	117	McDonald’s Big Mac (1 sandwich)	256
Salmon, with bones, 3 oz	167	McDonald’s Egg McMuffin (1 sandwich)	256
Sardines, with bones, 3 oz	371	Wendy’s broccoli and cheese potato (1)	250
Shrimp, canned, 3 oz	98	Chef’s salad, without dressing (1½ cups)	235
Tofu, piece, 1/2 cup	434	Quiche (1/8 pie)	224
Trout, 1 serving	210	McDonald’s Filet-o-Fish (1 sandwich)	165
Nuts/legumes (1/2 cup)		Cheeseburger, regular (1 sandwich)	182
Almonds	188	Pizza, meat and veg., thin crust (1/4 of 12")	166
Beans, dried, cooked	45	Burger King’s Croissan’wich (1 sandwich)	136
Brazil nuts	123	Spaghetti with meat balls (1 cup)	124
Garbanzo beans	150	Submarine sandwich (3 to 4" sub)	95
Hummus	66	Taco Bell’s taco (1 taco)	84
Lima beans	35	Dairy Queen’s hot dog (1 sandwich)	80
Peanuts	77		
Pistachio	86		
Pork and beans	67		
Refried beans	58		
Soybeans	130		
Walnuts	55		
Grain foods			
Pancakes 1, (2–3")	150		

Table 12 Iron Food Sources

Food	Approximate Measure	Iron (mg)	Food	Approximate Measure	Iron (mg)
High-iron sources			Venison, cooked	2 oz	2.0
Cream of wheat (quick or instant)*	1/2 cup	7.8	Wheat germ	1 oz (3 tbsp)	2.6
Heart, beef [†]	2 oz	3.7	Contributing iron sources		
Kidney, beef [†]	2 oz	5.3	Apricots, dried	4 large halves	1.4
Kidney, lamb [†]	2 oz	6.1	Breads, white enriched	1 slice	.6
Kidney, pork [†]	2 oz	5.3	Bread, whole wheat	1 slice	.5
Liver, beef [†]	2 oz	5.8	Chard	1/2 cup	1.5
Liver, calf [†]	2 oz	9.0	Chicken	2 oz	1.0
Liver, chicken [†]	2 oz	6.0	Dandelion greens	1/4 cup	0.9
Liver, lamb [†]	2 oz	10.9	Dates, dried	1/4 cup	1.3
Liver, pork [†]	2 oz	15.6	Egg, large	1	1.2
Liverwurst [†]	2 oz	3.6	Heart, chicken	9 to 10 medium	1.7
Prune juice	1/2 cup	5.1	Kale	1/4 cup	.6
Moderate-iron sources			Mustard greens	1/4 cup	.9
All-bran cereal	1/2 cup	2.9	Macaroni, enriched	1/2 cup	.6
Almonds, dried unblanched	1/2 cup	3.0	Noodles, enriched	1/2 cup	.7
Dried beans and peas			Peanut butter	2 tbsp	.6
Baked beans, no pork	1/4 cup	1.5	Raisins, dried seedless	1/4 cup	1.25
Blackeye peas, cooked	1/4 cup	0.8	Rice, long grain or instant	1/2 cup	.6
Broad beans, dry	1/4 cup	3.6	Salmon, canned	2 oz	.7
Chick peas, dry	1/4 cup	3.5	Shrimp, raw	2 oz	.9
Cow peas, cooked	1/4 cup	0.8	Spaghetti	1/2 cup	.8
Great northern beans, cooked	1/4 cup	1.3	Spinach	1/4 cup	1.3
Green peas, cooked	1/4 cup	1.4	Strawberries, raw cleaned	1 cup	1.5
Lentils, dry	1/4 cup	3.4	Tomato juice, canned	1/2 cup	1.05
Lima beans, cooked	1/4 cup	1.3	Tuna, canned	2 oz	1.1
Mung beans, dry	1/4 cup	3.6	Turnip greens	1/4 cup	0.8
Navy beans, cooked	1/4 cup	1.3	Waffle, enriched	5½" diameter	1.3
Red beans, dry	1/4 cup	3.5	Approximate iron content of children's favorite foods		
Soybeans, cooked	1/4 cup	1.4	Hamburger, small	1	3.0
White beans, dry	1/4 cup	3.9	Hamburger, large	1	5.2
Beef, cooked	2 oz	2 to 3 [‡]	Big Mac	1	4.3
Clams	3 medium	2.1	Quarter pounder	1	5.1
Ham, cooked	2 oz	1.3	Spaghetti with meatballs	1 cup	3.3
Heart, pork, cooked	2 oz	1.8	Frankfurters and beans	1 cup	4.8
Lamb, cooked	2 oz	1.9	Pork and beans	1 cup	5.9
Mackerel, canned	1/2 cup	1.0	Raisins	5/8 cup	3.5
Malt-o-meal, cooked	1/2 cup	1.4	Cereals, fortified	1 serving	4.5 to 17.8
Oysters	3 to 4 medium	2.8	Nuts	1 cup	5.0 to 7.0
Peaches, dried	1/4 cup	2.4	Seeds, sunflower	3½ oz	7.1
Peanuts, roasted without skins	3½ oz	3.2	Chile con carne	1 cup	3.6
Pork, cooked	2 oz	2 to 3 [§]	Beef burrito	1 medium	4.6
Prunes, dried	2 large	1.1	Beef tostado	1 medium	3.4
Sardines	8 medium	3.5	Cheese pizza	2 slices	3.0
Scallops	2 oz	1.6	Cheese pizza with beef	2 slices	4.8
Turkey, cooked	2 oz	1.7			
Veal, cooked	2 oz	2.0			

*Or other fortified cereals that contain 10 mg of iron per ounce or 100% recommended dietary allowance per serving.

[†]As organ meats are generally high in cholesterol, these iron-rich foods should be eaten in moderation.

[‡]Depending on cut. The greatest amounts of iron are generally found in the chuck, flank, and bottom round cuts of beef.

[§]Depending on cut. The greatest amounts of iron are generally found in the loin, sirloin, tenderloin, and picnic shoulder cuts of pork.

^{||}Raisins, nuts, and seeds are not generally recommended for children under age 3 because of the risk of choking.

tion of nonheme iron. Vitamin C-rich foods include citrus fruits and juices, cantaloupe, strawberries, tomatoes, and dark-green vegetables (see Appendix II, "Nutritional Requirements," for dietary reference intakes). Table 12 lists iron food sources.

WEIGHT CONTROL

The National Center for Health Statistics reports that the prevalence of overweight in children and adolescents is on the rise and has nearly tripled since the 1970s.¹⁴

Being overweight is considered to be the result of an imbalance of energy intake

and energy expenditure. Many factors can influence the upward trend in the prevalence of overweight in children, such as alterations in nutrient intake, changes in physical activity patterns, television viewing habits, level of nutritional knowledge, genetics, and parental influence (see Chapter 38, "Energy and Substrate Regulation in Obesity," for more information).

- Successful weight reduction and control incorporates a combination of caloric reduction, behavior modification, and exercise. Below are guidelines for healthful eating and weight reduction and control in children.

GOAL 1: PLAN ALL MEALS AND SNACKS

- Preplan menus to avoid impulse food choices.
- Do not skip meals; try to eat at the same times each day. Three meals and two or three snacks are sometimes better than only three large meals. There might be a greater risk of eating fattening snack foods when you are very hungry.
- Keep a box of low-calorie foods ready for between-meal snacks (eg, a variety of raw vegetable strips, rice cakes, popcorn, pretzels, fresh fruit).

- When away from home, take food along or know where appropriate foods can be purchased.
- Help make the shopping list and plan for low-calorie selections.
- Read food labels to limit products that list fats or sugars as main ingredients.
- Avoid fried foods (such as french fries and fried chicken), creamed products, and gravies.
- Avoid empty calories (foods such as chips, cakes, cookies, pies, pastry, regular soda, candy, jellies, and syrups) because these foods have very few nutrients and are high in fat or sugar calories or both.
- Preportion food for meals and snacks. Never eat food directly from the serving container or bag; this makes it too easy to overeat.

GOAL 2: EAT A WELL-BALANCED DIET

Eat a variety of foods from the Food Guide Pyramid to meet nutritional needs. The recommended number of servings and serving sizes for the various food groups are listed below:

- **Milk group:** Skim or 99% fat-free milk; non-fat yogurt (some yogurts contain large amounts of added sugar; compare labels); low-fat cheeses (less than 3 g fat per serving). Recommended number of servings: ages 2 to 8: 2 cups/d. age >8: 3 cups/d.
- **Meat group:** Lean cuts with little fat marbling; trim all fat from meat; remove skin of poultry; choose fish canned in water instead of oil; avoid processed deli meats, bacon, and sausage. Recommended number of servings: 5 oz/d.
- **Breads and cereals group:** Choose whole-grain or enriched products and plain cereals (not presweetened). Recommended number of servings: 6 oz/d.
- **Fruit and vegetables group:** Choose whole fruits that are fresh or canned in water and frozen fruits without added sugar. Choose unsweetened juice and limit to 4 oz (half cup) per day. Choose vegetables that are fresh, canned, or frozen and serve without butter, cheese, or sauces. Recommended number of servings: 4 cups/d.

GOAL 3: PREPARE FOODS THE LOW-CALORIE WAY

- Bake, broil, steam, roast, grill, or stir-fry foods.
- Spray pans with fat-free coating instead of using oil when frying.
- Do not add extra fat (eg, butter, margarine, oil, bacon, gravy) when cooking or for serving. Use herbs and spices to season foods instead of fats. Low-calorie butter substitutes (eg, Butter Buds) can provide the flavor of butter without the fat.
- Trim skin and visible fat off meats.
- Choose fat-free mayonnaise and fat-free salad dressings.

- Skim fat from homemade soups, stews, and gravies (refrigerate or freeze the product until the fat hardens and then spoon it off).
- Use skim milk in place of whole milk or cream when preparing soups, puddings, and home-baked products.

GOAL 4: AVOID EXCESS SUGAR

- Sugar and sugary foods provide many calories and very little nutrition and can cause tooth decay.
- Large amounts of sugar are contained in desserts such as cakes and cookies, as well as in soft drinks and candies.
- Sugar can be “hidden” in foods under such names as corn syrup, honey, fructose, and glucose. Read the label. If a sugar is listed as one of the first three ingredients on a food label, the product is probably very high in sugar.
- Beverages can be a major contributor of sugar and extra calories. Choose sugar-free sodas and sugar-free packaged drink mixes or water. Limit juice intake because even naturally sweetened products contain calories.
- It is not necessary to buy dietetic foods. Products marked “dietetic,” “lite,” or “light” are not necessarily low in calories. When a treat is desired, choose a lower calorie item such as Popsicles, Italian ice, Fudgsicles, angel food cake, fat-free frozen yogurt, or sugar-free pudding.

GOAL 5: EXERCISE

Activity is an important part of most successful weight control programs. Regular exercise will help burn extra calories all of the time, not just while exercising. Exercise also helps to strengthen the heart and tone muscles. Aim for at least 60 minutes of physical activity (including exercise or active play) most days of the week.¹² A 150-pound person will burn calories as listed in 30 minutes of continuous activity:

- Brisk walking, 93
- Dancing, 126
- Playing baseball, 141
- Cycling, 150 to 360
- Swimming, 180
- Playing basketball, 180 to 270
- Playing soccer, 270
- Running, 300 to 450
- Skipping rope, 300 to 450
- Walking up stairs, 300 to 540

GOAL 6: EAT OUT INTELLIGENTLY

- Limit restaurant and fast-food eating because such foods are generally high in fat and calories.
- Plan food selections to avoid meats and vegetables that have been fried (eg, select baked or broiled chicken in place of fried chicken).
- Choose a baked potato instead of fries.

- Order pizza without sausage, pepperoni, or extra cheese.
- When eating at fast-food restaurants, take advantage of salads, lean hamburgers, and fresh fruit cups.
- When selecting prepared-to-order foods, ask that the food be prepared with as little fat as possible.
- Avoid vegetables, meats, and starches that are topped with cheese, cream sauces, gravy, butter, or margarine.
- Because restaurant portions are often large, plan to take home some of your food.
- Ask for the salad dressing to be served on the side or request a low-calorie topping. If possible, eat salad without any dressing at all.
- Always ask for water with meals. Request low-fat or skim milk or sugar-free beverages.
- Plan ahead for school lunches. Review the menu and take lunch from home when the school lunch is high in fat or sugar.
- Order sandwiches without mayonnaise, special sauce, or extra cheese. Use mustard or fat-free spreads.

GOAL 7: MAKE POSITIVE CHANGES

- Maintain a positive attitude.
- When family members or friends are eating tempting foods, choose a low-calorie food (such as a sugar-free ice cream bar) or noncaloric beverage.
- Slow down the pace of eating to a minimum of 20 minutes per meal. This will allow the feeling of fullness to set in and help you enjoy the flavor of the food. If hunger persists after a meal, wait 20 minutes; if you are still hungry, choose low-calorie items such as plain vegetables or fresh fruit. Try to avoid second helpings of meats, desserts, and other high-calorie foods.
- Eat foods high in fiber, such as fresh fruits, vegetables, and whole grains, because they increase the feeling of fullness.
- Keep a food diary. Record everything eaten in order to become more aware of what and how much is actually eaten.
- Realize that change takes time. Select a few areas to work on and focus just on those until they have been mastered. Then add a few more areas needing change.
- If you eat too much of something, do not give up. Think about the positive changes that have been made and just get back on track.
- Measure weight only every 1 to 2 weeks to monitor progress. Do not get frustrated if sometimes results are not seen. A successful weight control program takes time, and a change in behavior is more important than any one weight measurement.
- Note that if a child has not attained adult height, significant weight loss could interfere with growth. Therefore, a dietitian might advise that weight maintenance rather than weight loss should be the goal while continuing to grow taller. The dietitian and physician

will help to determine weight goals. If a child is on a weight loss program, a 1- to 2-lb weight decrease per week is usually appropriate.

VEGETARIANISM

A vegetarian is typically defined as a person who avoids the consumption of animal flesh, such as meat, poultry, and fish.¹⁵ Dairy products and eggs might be included or avoided. When all dairy and egg sources are avoided, the diet is referred to as a vegan diet. A vegetarian diet can offer health advantages as a result of its high fiber and low saturated fat content. The American Dietetic Association's position statement on vegetarian diets indicates that appropriately planned vegan and lacto-ovo vegetarian diets can meet the nutrient needs of infants, children, and adolescents and can promote normal growth.

- Dietary deficiencies, however, are possible with overly restrictive diets. All children following a vegan diet should have a reliable source of vitamin B₁₂ and vitamin D (ie, they should receive a vitamin supplement). In addition, emphasis should be placed on the intake of foods rich in calcium, iron, and zinc. Children following a vegetarian diet might need to eat foods higher in fat to meet energy needs for appropriate growth and development.

VEGETARIAN GROUPS AND RESOURCES

Vegetarian Resource Group, PO Box 1463, Baltimore, MD 21203; telephone: 410-366-8343; www.vrg.org

American Dietetic Association. Position statement on vegetarian diets. *J Am Diet Assoc* 1997;97:1317-21.

Katzen M. *The New Enchanted Broccoli Forest*. Berkeley, CA: Ten Speed Press; 2000.

Katzen M. *New Moosewood Cookbook*. Berkeley, CA: Ten Speed Press; 2000.

Lappe FM. *Diet for a Small Planet*. 20th anniversary edition. New York: Ballantine Books; 1991.

Robertson L, Flinders C, Ruppenthal B. *The New Laurel's Kitchen: A Handbook for Vegetarian Cookery and Nutrition*. Berkeley, CA: Ten Speed Press; 1986.

Vegetarian Times, PO Box 420235, Palm Coast, FL 32142-0235; telephone: 877-717-8923; www.vegetariantimes.com

WEB SITES FOR GENERAL INFORMATION

American Academy of Pediatrics: www.aap.org

American Dietetic Association: www.eatright.org

American Heart Association: www.americanheart.org

National Academy Press Dietary Reference Intakes: www.nap.edu

United States Department of Agriculture Food and Nutrition Information Center: www.usda.gov

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