



# NCC Pediatrics Continuity Clinic Curriculum: **Nutrition II: School-Age & Adolescent Faculty Guide**

## **Goal:**

To understand the nutrition recommendations and key issues for school-age children and adolescents, and to be able to translate them into practical, anticipatory guidance for parents.

\* Note: Obesity will be covered separately in the Nutrition III Module.

## **Pre-Meeting Preparation:**

- Excerpts from HealthyChildren.org on School-Age & Adolescent Nutrition
- “Vegetarian Diets in Children and Adolescents”
- “Treatment of Eating Disorders in Children, Adolescents, and Young Adults”
- **Be prepared to provide a case-example or FAQ related to School-Age & Adolescent Nutrition from your continuity clinic experience. Discuss how you approached the case or question.**

## **Conference Agenda:**

- Complete Nutrition II Quiz & Case Studies
- **Round table discussion of *resident* School-Age & Adolescent cases**

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

## **Extra Credit:**

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

- [AAP Clinical Report on Eating Disorders \(2010\)](#)—includes SCOFF mnemonic
- [Vegetarian Eating for Children and Adolescents](#) (2006)

## School-Age Nutrition

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

### Calories & Servings

As the middle years progress, children's total energy needs will increase and thus their food intake will rise, especially as they approach puberty. Between ages 7 and 10, both boys and girls consume about **1,600 to 2,400 calories per day**. Most girls experience a significant increase in their growth rate between ages 10 and 12 and will take in about 200 calories more each day, while boys go through their **growth spurt** about 2 years later and increase their food intake by nearly 500 calories a day.

Some parents worry that throughout the school age years, there seems to be no rhyme or reason to their children's appetite. **Appetites can vary**, even from day to day, depending on factors like activity levels. A child who spends the afternoon doing homework, for example, may have fewer caloric needs than one who plays outdoors after school.

At the same time, children in this age group eat for a lot of reasons besides hunger. They could be upset or tired and relying on food for comfort. When your youngster says that he's hungry and it's not a regular meal or snack time, try to determine whether food might be serving some other purpose. Then help him find an activity that will keep him occupied doing something productive.

Ultimately, children in early to middle adolescence should be gaining **4 to 7 lbs per year**. As long as your child is growing normally, keep your focus on serving a variety of healthy foods.

### Variety & Nutrients

Your child should consume a variety of foods from the five major food groups that make up the "**Food Plate**" developed by the U.S. Department of Agriculture in July 2011, to replace the "Food Pyramid".



**Vegetables:** 3-5 servings/day. Serving = 1 cup of raw leafy vegs, 3/4 cup of veg juice, or 1/2 cup of other vegs, chopped raw or cooked.

**Fruits:** 2-4 servings/day. Serving = 1/2 cup sliced fruit, 3/4 cup of fruit juice, or a medium-size whole fruit.

**Bread, cereal, or pasta:** 6-11 servings/day. Serving = 1 slice of bread, 1/2 cup of rice/pasta, or 1 oz of cereal.

**Protein foods:** 2-3 servings of 2-3 oz of cooked lean meat, poultry, or fish per day. Serving also = 1/2 cup of cooked dry beans, 1 egg, or 2 TBSPs of peanut butter for each oz lean meat.

**Dairy products:** 2-3 servings/day of 1 cup of low-fat milk or yogurt, or 1.5 oz of natural cheese.

### **Foods to Reduce:**

- **Fat:** High fat intake, particularly saturated fats (solid at room temp), can increase cholesterol and lead to coronary artery disease. *After age 2*, children should be served foods lower in saturated fats (e.g. poultry, fish, lean meat—not fried; low-fat dairy; low-saturated-fat oils; soft margarine—not butter; limited eggs). In general, **fats should make up <30% of calories in your child's diet**, with >2/3 of those fat calories coming from *unsaturated* fats (liquid at room temp—e.g. corn, safflower, sunflower, soybean, and olive oil).

- **Sugar:** Many children consume sugar in great quantities, usually at the expense of healthier foods (e.g. sodas and juice, instead of milk or water). Keep consumption at moderate levels.
- **Salt:** The habit of using extra salt is acquired. Thus, as much as possible, serve your child food low in salt, to decrease the risk of high blood pressure. Use herbs, spices, or lemon juice to flavor foods and avoid processed foods such as cheese, instant puddings, canned vegetables and soups, hot dogs, salad dressing, pickles, and potato chips.

## Vitamins

**Supplements are rarely needed** in middle childhood, since a balanced diet contains sufficient quantities for the essential vitamins and minerals. However, children with poor appetite, erratic eating habits, or highly selective diets (e.g. vegetarian or vegan) may need vitamin supplements.

Over-the-counter supplements (e.g. [Flintstones chewables or gummies](#)) are generally safe; however, if taken in excessive amounts or combined, some—particularly fat-soluble vitamins (ADEK)—can be toxic. Of note, “**mega-vitamin therapy**” or “orthomolecular medicine”—in which vitamins are given in extremely large doses for conditions ranging from the common cold to hyperactivity—has no proven scientific validity and may pose risks.

Following are some of the vitamins and minerals necessary for normally growing children, and some of the foods that contain them. (*See the chart following this section for a more complete list of vitamins and the conditions associated with deficiency or excessive intake*).

- **Vitamin A** promotes normal growth, healthy skin, and tissue repair, and aids in night and color vision. Rich sources include yellow vegetables, dairy products, and liver.
- **B vitamins** promote red blood cell formation and assist in a variety of metabolic activities. Found in meat, poultry, fish, soybeans, milk, eggs, whole grains, and enriched breads and cereals.
- **Vitamin C** hastens the healing of wounds and increases resistance to infection. Found in citrus fruits, strawberries, tomatoes, potatoes, Brussels sprouts, spinach, and broccoli.
- **Vitamin D** promotes tooth and bone formation and regulates calcium absorption. Sources include fortified dairy products, fish oils, fortified margarine, and egg yolks. Sunlight also contributes to dietary sources of vitamin D, stimulating the conversion in the skin.

## Adolescent Nutrition

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

## Calories & Servings

The body demands more calories during early adolescence than at any other time of life. On average, **boys require about 2800 calories per day; and girls, 2200 calories per day**. Typically, the ravenous hunger of adolescence starts to wane once a child has stopped growing, though not always. Kids who participate in physical activity will still need increased amounts of energy into late adolescence.

**Serving sizes for teenagers should still be about the same as they are for adults.** Please review the chart on the following page to see the number of servings and sizes recommended for the average teen. The USDA “Food Plate” can still be used as a visual guide.

<u>Food Group</u>	<u>Number of Servings Per Day</u>	
	<u>Females</u>	<u>Males</u>
Calories	Aged 11-24 Total Calories: 2,200	Aged 11-14 Total Calories: 2,500
		Aged 15-18 Total Calories: 3,000
		Aged 19-24 Total Calories: 2,900
Bread, Cereal, Rice and Pasta Group 6-11 servings	9 servings	11servings
Milk, Yogurt and Cheese Group 4-5 servings	4 or 5 servings	Aged 11-18: 4 or 5 servings Aged 19-24: 2-3 servings
Vegetable Group 3-5 servings	4 servings	5 servings
Fruit Group 2-4 servings	3 servings	4 servings
Meat, Poultry, Fish, Dry Beans, Eggs and Nuts 2-3 servings	6 ounces total	7 ounces total
Total Fat	73 grams	Aged 11-14: 83 grams Aged 15-18: 1,000 grams
Total Added Sugar	12 teaspoons	18 teaspoons

## Variety & Nutrients

There are a number of obstacles to balanced adolescent nutrition:

- **Skipping meals:** According to a recent poll, about ½ boys and girls aged 9-15 years said that they didn't eat breakfast on school mornings. Breakfast-to-go options include a bagel and peanut-butter, a hard-boiled egg, nuts & raisins, a yogurt, or an apple.
- **Snacking:** 1/3 of the caloric intake of adolescents comes from snacks—particularly unhealthy ones. It's therefore important to keep the refrigerator and pantry stocked with healthy options like low-fat cheeses, applesauce, air-popped popcorn, and baked potato chips.
- **Eating away from home:** At school, adolescents will often settle for a stop at the vending machine for lunch. After school, they may decide that fitting in with their peers at a fast-food restaurant or pizza shop is more important than making healthy food selections. Brainstorm healthy alternatives and/or other activities to do with their peers.
- **The lure of fad diets:** As teenage girls “hopscotch” from one fad diet to another, good nutrition may fall by the wayside. Reinforce that these diets are too restrictive and unhealthy and bad for weight-loss in the long-run.

The guidance in the above section for “Foods to Reduce” still applies to adolescents. Also remember, each gram of protein and carbohydrates supplies 4 calories, whereas **fat contributes 9 calories/gram**.

## Vitamins

Adolescents—particularly girls, who eat roughly 25% fewer calories per day than boys—tend to fall short of their daily quotas of vitamins and minerals. Calcium, iron and zinc are most vulnerable.

**Calcium:**

Adolescence provides a window of opportunity for avoiding osteoporosis later in life. During the teenage years, the growing bones absorb more calcium from the blood than at any other time of life. By early adulthood, our bones stop accepting deposits, and not long after, the gradual loss of calcium begins.

In a clinical study sponsored by the National Institute of Child Health and Human Development, one group of teenage girls received daily supplements containing an extra 500 mg calcium; the other group's calcium came strictly from food. The girls who were given supplements saw their bone density improve by 14%. Each 5% increase in bone mass reduces the risk of suffering a bone fracture by 40%.

The American Academy of Pediatrics recommends the following daily intake of calcium:

Age	Calcium Need (mg per day)	Servings of Milk to Meet Need
4–8 years	800	3 servings
<b>9–18 years</b>	<b>1,300</b>	<b>4 servings</b>
19–50 years	1,000	3–4 servings

Milk and milk products provide ¾ of the calcium in the American diet. Other foods contain calcium, like broccoli and collard greens. However, these vegetables also contain substances that impair the body's ability to absorb calcium, so that a teen would need to eat approximately 9 cups of broccoli a day to meet the recommended intake. Also consider calcium-fortified juice (no more than 8-12 oz/day!) and cereals.

Unfortunately, 2/3 of adolescent girls in the US fail to meet the daily requirement for calcium. The NIH supports the use of supplements for young people who don't get sufficient calcium through their diet. For optimal absorption, no more than 500mg should be taken at one time.

Also remember that other factors can decrease calcium and impair bone health: excessive soda intake; vegan diets; caffeine, alcohol, and tobacco; certain medications (e.g. diuretics) and GI diseases (e.g. IBD).

**Iron:**

According to a national survey conducted by the USDA, three in four teenage girls' diets are deficient in this essential mineral, as compared to just one in five of their male counterparts. Adolescent girls are also prone to iron-deficiency due to menstrual losses.

Foods rich in iron include meats (beef, pork, lamb, liver); poultry (especially dark meat); fish; dark-green leafy vegetables (kale, collards, broccoli); legumes (lima beans, peas, dry beans); dried fruit (prunes, apricots, raisins); potatoes with skin; seeds (sunflower, pumpkin, squash); and whole-wheat breads.

Other points to keep in mind are, as follows: (1) the iron in meat, poultry, and fish is more readily absorbed than the iron in vegetables, beans, and grains; (2) vitamin C & citric acid in fruits promotes absorption of iron; (3) the tannins in tea can interfere with metabolism of non-heme (i.e. non-meat) iron.

Please review "Screening for Iron Deficiency" in the [Health Maintenance III Module](#) for more information about the pathophysiology, evaluation, and treatment of iron-deficiency anemia.

## Vitamin Deficiency & Overdose Chart:

Vitamin	Chemical Names	Deficiency disease	Overdose disease
A	Retinol, retinal, and 4 carotenoids (e.g. beta carotene)	<b>Night-blindness</b> , poor immunity (e.g. measles morbidity)	<b>Hypervitaminosis A</b> (birth defects, liver toxicity, angular cheilitis, hair loss, ICH)
B <sub>1</sub>	Thiamine	<b>Beriberi</b> (weakness, edema, CHF); Wernicke syndrome (confusion, ataxia, ophthalmoplegia)	Drowsiness or muscle relaxation
B <sub>2</sub>	Riboflavin	Ariboflavinosis (angular cheilitis, mouth ulcers, scrotal dermatitis)	
B <sub>3</sub>	Niacin, niacinamide	<b>Pellagra</b> (4Ds = Diarrhea, Dermatitis, Dementia, Death)	Liver damage; skin flushing; eczema; maculopathy
B <sub>5</sub>	Pantothenic acid	Paresthesia	Diarrhea; nausea & heartburn
B <sub>6</sub>	Pyridoxine, pyridoxamine, pyridoxal	Seborrheic dermatitis, atrophic glossitis; <b>peripheral neuropathy</b>	Impairment of proprioception, nerve damage
B <sub>7</sub>	Biotin	Dermatitis, enteritis	
B <sub>9</sub>	Folic acid, folinic acid	Megaloblastic anemia; <b>neural tube defects</b>	May mask symptoms of vitamin B <sub>12</sub> deficiency
B <sub>12</sub>	Cyanocobalamin, hydroxycobalamin, methylcobalamin	<b>Megaloblastic (pernicious) anemia</b> , neurologic & GI sx's	Acne-like rash
C	Ascorbic acid	<b>Scurvy</b> (lethargy, myalgia, easy-bruising, gum disease, psych Δs)	<b>Vit C megadosage</b> (diarrhea, kidney stones, iron overload)
D	Cholecalciferol	<b>Rickets</b> and Osteomalacia	<b>Hypervitaminosis D</b> → hyperCa <sup>2+</sup> (groans, moans, stones, bones, psych overtones)
E	Tocopherols, tocotrienols	Rare; <b>mild hemolytic anemia</b> in newborns; spinocerebellar ataxia	Fatigue, diarrhea, headache
K	phylloquinone, menaquinones	<b>Bleeding diathesis</b> (e.g. HDN)	Increases coagulation in patients taking warfarin.

# Vegetarian Diets in Children and Adolescents

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Drs Renda and Fischer have disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

## Introduction

Vegetarianism is becoming more common among adults, with 1 in 40 adults currently choosing a vegetarian diet. Consequently, more children are raised as vegetarians. Vegetarianism is adopted for various reasons, including moral, religious, and health. Numerous studies have shown significant health benefits for individuals following this type of diet. Pediatricians should be well informed about vegetarianism and its role in our pediatric population.

## Case 1

*A first-time mother and her 2-month-old boy present to the clinic for a health supervision visit. The mother is breastfeeding, and her baby is growing appropriately. At the end of the visit, the mother mentions that she is a vegetarian and that she would like to raise her son in the same way. She would like to know what she should be doing as a breastfeeding mother and how she can make sure that her son has the appropriate nutrition in the future.*

The physician should begin by taking a dietary history from the mother to determine what type of vegetarianism she practices. He or she should explain to the mother that her infant's nutrition is based on her own dietary intake for as long as she continues to breastfeed. The pediatrician should counsel the mother on the importance of diet variety. If the mother is vegan, the pediatrician must take time to ensure that she is getting enough vitamin B<sub>12</sub> and calcium in her diet. When she is ready to wean her infant, she should continue to focus on dietary variety. The mother should be cautioned that adult vegetarian diets that are high in bulk and low in calories are not always appropriate for the growing and developing child. Finally, the pediatrician should ensure that the mother has the appropriate resources to guide her in finding the best foods for her child's nutritional needs.

## Initiating a Dialogue

When confronted with this scenario, it is most important to take a dietary history. Although this mother defines herself as a vegetarian, she did not specify what type of vegetarianism she practices (Table 1). In the simplest sense, a vegetarian eliminates animal-flesh foods and products from the diet (including fish). However, the definition can be delineated further. A lacto-ovovegetarian consumes milk and egg products. A lactovegetarian consumes milk in addition to plant products. A vegan eliminates all animal and fish products. Recommendations for this mother depend on what form of vegetarianism she follows.

## Comparing Human Milk Composition

For the first 6 to 12 months after birth, most babies are lactovegetarians. Their primary source of nutrition is milk, either from human milk or formula. Studies have shown that for the first 6 months, the human milk of a lacto-ovovegetarian does not differ significantly from that of an omnivore. (1) Specifically, the composition of human milk between lacto-ovovegetarians and omnivores is similar in minerals, trace elements, lactose, and total fat. Another study revealed that human milk from vegetarians has fewer environmental and indirect additives than that of nonvegetarians. (2)

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Table 1. Types of Vegetarianism

<b>Semivegetarian</b>
Includes poultry and fish
<b>Lacto-ovovegetarian</b>
Includes milk and egg products
<b>Lactovegetarian</b>
Includes milk products
<b>Vegan</b>
Eliminates all animal and fish products

### Important Nutritional Considerations

Lacto-ovovegetarians and lactovegetarians (who consume milk or eggs or both in their diet) tend to be less deficient in certain elements than vegans, who eliminate all fish and animal products. Surprisingly, the human milk of poorly nourished women often has relatively adequate volume and composition. One hypothesis is that human milk composition is maintained to the detriment of the mother's overall nutritional status. Regardless of the volume and composition, human milk of poorly nourished women may have fewer calories, water-soluble vitamins, calcium, and protein. (3) All vegetarians should pay special attention to the amount of vitamin B<sub>12</sub>, folate, and omega-3 fatty acids that they consume. Vitamin B<sub>12</sub> and folate are important factors in protein and DNA synthesis as well as in growth and development of the brain and nervous system. Omega-3 fatty acids play a significant role in brain and retinal development. During times of growth and reproduction, requirements for these elements increase.

#### Vitamin B<sub>12</sub>

Reliable sources for vitamin B<sub>12</sub> for the vegetarian include cereal, nondairy beverages, meat analogs, and supplements. It is important to read the labels to ascertain that the item has been fortified with vitamin B<sub>12</sub>. If a vegan mother does not consume enough B<sub>12</sub>-fortified foods or supplements, her infant receives 0.4 mcg/day of vitamin B<sub>12</sub> during the first 6 postnatal months and 0.5 mcg/day after 6 months of age. (4) Another reason that a breastfed infant might need to receive supplementation with vitamin B<sub>12</sub> is if the mother had an ileal resection. Removing this section of the bowel prevents the body from absorbing vitamin B<sub>12</sub>.

#### Folate

Folate is found in enriched breads, pastas, cereals, green leafy vegetables, and orange juice. Interestingly, most vegetarians consume more than the recommended amount of folate. Although the addition of folate to fortified foods has helped to reduce the risk of neural tube defects in infants, folate can mask some of the hematologic changes that signal a vitamin B<sub>12</sub> deficiency. A vitamin B<sub>12</sub> deficiency that has been masked by folate may not be apparent until deleterious neurologic consequences already have occurred. (5)

#### Omega-3 Fatty Acids

Omega-3 fatty acids are important in all lactating women because they assist in brain and retinal development of nursing infants. However, they also serve a special role for vegetarians because they act as building blocks for the longer chain fatty acids docosahexaenoic (DHA) and eicosapentaenoic acid (EPA), which are found in fish. DHA and EPA are critical for brain and organ development in the fetus and newborn. A daily intake of 3 to 5 g of omega-3 fatty acids is adequate, based on a 2,000-kcal/day diet. However, lactating women (especially vegetarians) should consider supplementation with reliable sources of fatty acids. Omega-3 fatty acids can be found in walnuts, flax seed, hemp, dark greens, and tofu. Quality fish oil supplements and DHA-rich eggs also are available for consumption. (6)

#### Weaning Future Vegetarians

When weaning infants from human milk, it is important to ensure that they receive adequate nutrition. Dietary problems that stem from certain inadequacies are seen more often in children than in adults. Children have greater energy requirements relative to their body weight, and they are not always in control of what they eat. Many of the significant deficiencies seen in children occur because of inappropriate understanding and dietary choices by adults.

Vegetarian diets that are appropriate for adults are not always right for children. Adults tend to want to consume foods that are lower in caloric and fat content, yet high in bulk. The bulk ensures that the stomach feels full despite the adult consuming a lesser amount of calories and fat. A child who is 1 to 3 years of age has a stomach capacity of only 200 to 300 mL at each meal. Thus, problems ensue when high-bulk foods are eaten by children. Children may feel satiated quickly, even though they have not eaten an adequate amount of their nutritional requirements. (7)

When well-informed parents raise vegetarian children,

studies show that the children’s means for height for age, weight for age, and weight for height are close to the 50th percentile of the National Center for Health Statistics reference values. (8) Another study of vegetarian British children, ages 1 to 18 years, found heights, weights, and head and chest circumferences to be within normal range compared with those of nonvegetarian British children. (9)

### Dietary Variety is the Secret to Success

When a vegetarian follows a well-rounded diet, the health benefits are numerous. In an analysis of five prospective studies examining mortality in vegetarians and nonvegetarians, vegetarians had a 24% decrease in ischemic heart disease. (10) Vegetarian children tend to be leaner and have lower relative body weights and skinfold thicknesses while retaining normal growth and maturation. (11) As food sources become increasingly fortified, it is easier and more convenient to provide vegetarian children with appropriate food elements. Parents should ensure that their children are receiving adequate amounts of vitamin B<sub>12</sub>, folate, iron, and zinc (Table 2). Food also should be high in energy density without significant bulk.

Toddlers and preschool-age children tend to develop strong eating preferences, and it may be difficult to present a variety of foods to them each day. Patience, along with repeated exposure to unfamiliar foods, may help. When opting for prepackaged foods made with tofu or tempeh (fermented soy), it is important to read the nutritional information. Many of these processed foods tend to be high in fat, sodium, and calories, similar to nonvegetarian packaged foods.

Parents should make “whole plant food” the primary staple in their child’s diet. This element includes whole grain breads, pastas, cereals, tofu, soy, legumes, vegetables, and fruits. Legumes are a class of vegetables that includes a variety of beans, peas, and lentils. Nutrients in vegetables are preserved best when they are cooked with the least amount of heat, water, and time. Therefore, ideal cooking includes steaming vegetables in a small amount of water, stir-frying, and boiling in a bag. As mentioned, vitamin B<sub>12</sub> and folate are found in a variety of fortified cereals and breads. Iron can be found in dried fruits, legumes, nuts, and fortified foods. Zinc also is found in legumes, nuts, and whole grains.

Although protein can be a concern, plant foods provide more than 10% of their calories in the form of protein. Plant foods combined with meat substitutes such as soy and tempeh tend to provide adequate protein for the vegetarian child. The protein intake of vegan children has been shown to be similar to that of nonvegetarian children, and the intake also is higher than the recommended standard. (12)

### Case 2

*A new patient and his parents present to the clinic for a health supervision visit. The boy is 7 years old and has had appropriate growth and development. The parents are lacto-ovo vegetarians, and they have raised their son in the same way. As their son becomes older and more independent, they have concerns about his eating patterns and nutrition. They want to ensure that he makes appropriate food choices at school and at friends’ houses. They ask you for advice in ensuring that he continues to have appropriate nutrition now and in the future.*

It is important to identify the parents’ reasons for being vegetarian as well as their reasons for raising their son as a vegetarian. It also is essential that the physician ask both the parents and child how each feels about being vegetarian. Although the boy is only 7 years old, he most likely is exposed to many different types of food while at school and friends’ homes. How have these experiences influenced his feelings about his daily diet? The physician should follow this discussion with a dietary history. If

Table 2. Nutrients and Food Sources

Protein
Tofu, tempeh, legumes, grains, eggs, dairy
Omega-3 Fatty Acids
Flax seed, dark greens, tofu, fish oil, nuts
Iron
Legumes, nuts, dried fruit, spinach, fortified grains
Calcium
Kale, broccoli, fortified orange juice, fortified soy, figs, dairy
Zinc
Whole grains, legumes, nuts, wheat germ, whole grain pasta
Folate
Legumes, dark green leafy vegetables, fortified cereals/breads
Vitamin B <sub>12</sub>
Fortified eggs, fortified dairy, cereals, breads, some fortified soy

additional education is needed to teach the family about appropriate nutrition, more time should be arranged to delve into this issue. The physician should ensure that this family has the appropriate resources available to them. Finally, the physician needs to begin to touch on the topics of independence and autonomy. Depending on how this boy feels about being a vegetarian, the physician may want to counsel the parents on ways that they can be accepting of their son regardless of whether he chooses to be vegetarian in the future.

### Raising a School-age Vegetarian

From a nutritional standpoint, raising a school-age vegetarian is not very different from raising a younger vegetarian. These children require the same nutritional considerations as their younger counterparts, with particular attention paid to elements such as vitamin B<sub>12</sub>, folate, omega-3 fatty acids, and protein. Dietary variety is the best way to ensure normal growth and development for vegetarian children.

Aside from the nutritional issues, however, many other aspects of vegetarianism during elementary school ages should be considered. Whereas the toddler or preschool-age child is still eating most of his or her meals at home, the school-age child often eats a large portion of his or her daily diet away from the home (school, extracurricular activities, friends' homes). Not only is it more difficult for parents to be in control of what their children are eating, but it also may be difficult for the child to make appropriate choices based on the foods that are available.

The school-age child places a great deal of interest and importance on fitting in among his or her social group. Acceptance in one's social group often depends on the ability to relate to other children and share in common experiences. If a vegetarian child is unable to share in common experiences, such as meals, this state may be distressing for the child and peers alike.

Finally, school-age children are just beginning to realize that children and families are not all similar to their own. Depending on school and social experiences, some vegetarian children may be exposed to many different foods that they have never encountered. Curiosity may cause vegetarian children to desire new foods, including meat products. If vegetarian children feel that they are unjustly restricted, or if the restriction causes them distress, they may begin to resent their vegetarian diets.

To identify and resolve issues related to school-age vegetarians, parents should determine how strongly they feel about reinforcing a vegetarian diet inside and outside of the home. As children enter school and become more

independent, some parents allow their children the freedom of dietary experimentation. Others may feel that a vegetarian diet takes precedence, regardless of the circumstances. Once a viewpoint has been determined, parents should include their children in a discussion that tackles the issues pertinent to school-age vegetarians.

### Planning Ahead

Because of the many motivations and rationales for choosing vegetarianism, parents' discussions will differ among their children. Regardless of the differences, parents can be more prepared to work through specific issues if they have some universal tools at their disposal.

Following a vegetarian diet can be challenging to even the most experienced vegetarian. Despite advancing public awareness, vegetarian options are not always available; planning ahead is often necessary. This proves to be of greater consequence when a child is involved. The vegetarian school-age child always should leave the house with an appropriate meal or at least with a snack that he or she can eat if there are no vegetarian options. If peer inclusion is an issue, parents should think about packing vegetarian foods that mimic popular meat products (ie, veggie burger, soy nuggets). Children feel more included in peer groups if their meal appears similar.

Packing food for other situations may be more complex. If a vegetarian child is asked to dinner at a friend's house, the child and his parents may seem impolite if the child brings his or her own food. In this case, communication is the key. Once nonvegetarian parents understand the situation, they may be very accommodating in terms of offering food that is appropriate for the vegetarian child. On the other hand, some parents may welcome help from a vegetarian parent in terms of suggesting or packing appropriate foods. Parents of nonvegetarian children may be very agreeable to preparing foods for their vegetarian guest, but they may not know what to cook. Vegetarian parents can offer some basic education if they think other parents would be open to suggestions.

Although planning ahead can address many scenarios, parents and children should role-play to practice scripts that deal with unexpected situations. Role-playing is particularly useful because it may help parents understand what type of circumstance causes their children the most worry or apprehension. Acting out a few scenarios can do wonders in terms of quelling a school-age vegetarian's concerns regarding diet.

Finally, it is important for parents to discuss vegetarianism and nonvegetarianism in a way that does not place undue positive or negative values on either group. A common defense mechanism for parents of a vegetar-

ian child who is questioning his or her diet may be to speak of nonvegetarians negatively. This type of coping skill is detrimental because it accentuates the differences that already are of concern to the vegetarian child. It also may have a paradoxical effect in that the vegetarian child may have heightened negative feelings about his or her diet if the child feels that his or her parents have spoken negatively about a cherished friend or peer. Parents should attempt to discuss issues of diet with objectivity. In doing so, they will make their argument more effectively without alienating others.

### Case 3

*A 16-year-old girl returns to the pediatric clinic for her first health supervision visit in 5 years. When questions arise concerning her diet, she appears very defensive. She states that she became a vegetarian on February 16, approximately 2 months ago. She reluctantly shares that her diet consists largely of pasta, bagels, and “side dishes” from the family meal. She cites “animal cruelty” as her motivation to become a vegetarian.*

The physician should begin by taking a dietary history as well as attempting to determine what prompted this teen to change her diet, remembering that adolescence is a unique period of development that may have played a role in this teen’s motivations. To provide the most comprehensive education regarding vegetarianism, the teen’s family should be included in the discussion whenever possible. The physician should ensure that the teen and her family have access to accurate resources that can provide them with important information. Finally, the physician should take the time to ensure that this teen’s decision to be vegetarian was not based on an underlying emotional problem, including an eating disorder.

### Adolescent Vegetarians: A Unique Challenge

During adolescence, youth assert their independence, develop their self-identity, and build relationships with both sexes. Adolescent vegetarians should not be thought of as younger versions of adult vegetarians. The common adult explanations for a vegetarian diet include health, religious, familial, and cultural reasons. However, these motives do not always influence adolescents in the same way. Often, the decisions that adolescents make are related directly to their developmental needs and developmental stage. (13)

The most challenging of adolescent vegetarians is one who has been raised as an omnivore and who decides to change dietary habits independent of his or her family’s eating style. Of a sample adolescent population in Minnesota of just fewer than 20,000 individuals, 0.6% of

adolescents identified themselves as vegetarians. (14) The starting point for an appropriate dialogue with a teenage patient is similar to that of a breastfeeding mother: taking a dietary history. It is most important to ascertain what it means to this young woman to be a vegetarian. Similarly, how does she define and apply this form of diet in her own life?

### The Typical Adolescent Vegetarian

Most adolescent vegetarians tend to be female. In one study that investigated adolescent vegetarians in Minnesota, 81% of self-identified vegetarians were female, and only 19% were male. (14) Most often, adolescent vegetarians share negative feelings toward eating meat, feel strongly about animal cruelty, and place more importance on their appearance and environment. (13) Another common characteristic of adolescent vegetarians is that they engage in many positive behaviors. Adolescent vegetarians tend to consume more fruits and vegetables while consuming fewer sweet and salty snack foods. These youth also tend to weigh less than their nonvegetarian peers.

An important aspect of adolescence is that many decisions are made impulsively and without much consideration for the future. Consequently, positive aspects of vegetarianism also can lend themselves to negative or harmful behaviors. All vegetarians are at risk for nutritional inadequacies if they do not consume appropriate amounts of foods rich in protein, iron, calcium, and zinc. Adolescents are at even greater risk if their decisions to become vegetarian were sudden and without proper attention to necessary details and information.

The adolescent patient in this case revealed a distinct date in history when she changed her eating habits. Her sudden dietary changes, as well as her current food choices, imply that her decision was not well researched. If she were to continue to eat the foods that she describes (pastas, bagels, and “side dishes”), she would be at risk for specific nutritional deficiencies. However, adolescents frequently have difficulty imagining the future, and it can be challenging to impress on them future consequences. Regardless, efforts should be made to prepare them for the future because adolescents will be in charge of all their dietary choices once they leave the home for college or employment.

### The Vegetarian Food Guide Pyramid, a New Model

To capitalize on positive benefits and minimize negative consequences, it is important that adolescent vegetarians receive appropriate counseling and guidance regarding

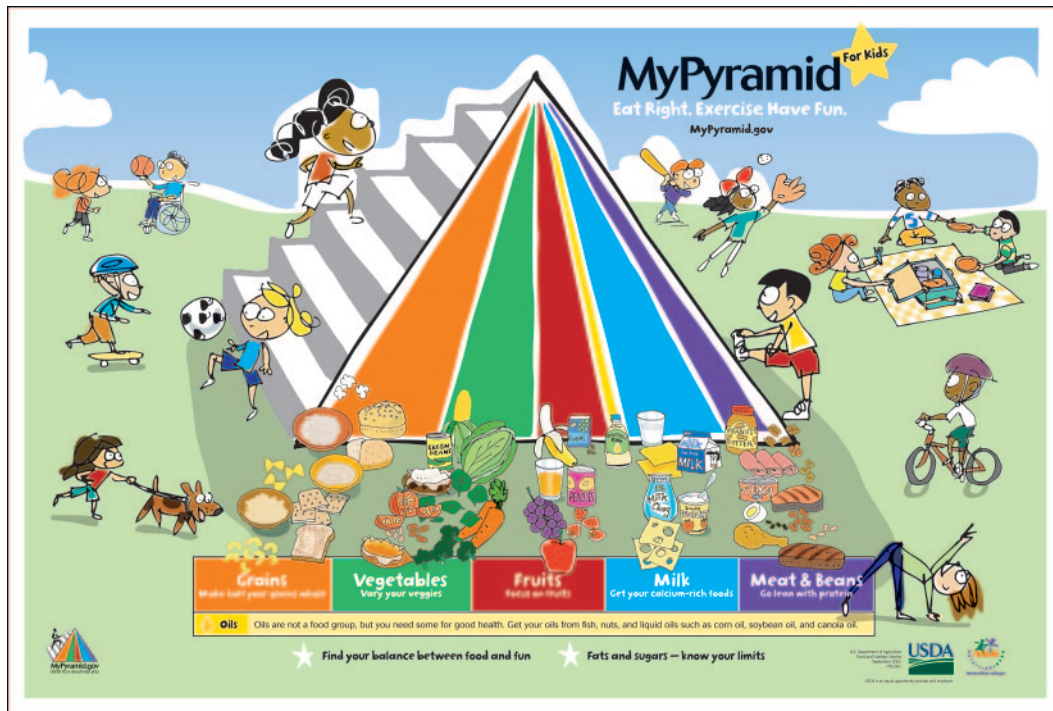


Figure 1. The Food Guide Pyramid.

their dietary choices. One of the challenges in providing appropriate information is the limited number of easily accessible models that demonstrate what foods are important and how they should be applied to the diet. Most adolescents are familiar with the Food Guide Pyramid, a model that shows how nutritional guidelines and requirements fit into one’s daily food choices (Fig. 1). The difficulty in using the Food Pyramid as a guide when talking to vegetarian adolescents is that it targets a population of omnivores. Thus, the nutritional standards are based on a nonvegetarian diet. (15)

There are adaptations of the food guide to account for vegetarianism. One example is the United States Department of Agriculture’s Food Guide Pyramid. In this guide, flesh foods are eliminated from the protein food group. Unfortunately, this guide does not take into account that some vegetarians exclude all animal and fish products. Therefore, dairy products and eggs also should be eliminated. Additionally, the proportions of the pyramid no longer are appropriate because certain staple foods have been removed without accounting for relative proportions or nutrient composition.

When presented with accurate information, vegetarians can fulfill all of their nutritional requirements in all stages of life. Many individuals would like to become vegetarians because they are aware of the health benefits.

However, these individuals are at a loss as to how to make the transition when there are no appropriate and easily accessible guides.

Recently, a Vegetarian Food Guide Pyramid was introduced to the United States Congress by organizers of the Third International Congress on Vegetarian Nutrition (Fig. 2). (15) The bottom tiers of the pyramid consist of the five major plant-based food groups: whole grains, legumes, vegetables, fruits, nuts, and seeds. At the top of the pyramid are the foods that may or may not be included in a vegetarian diet: vegetable oil, dairy, eggs, and sweets. The hope is that this provisional guide will motivate additional research and development of future guides. (15)

### Involving the Family

Another opportunity to counsel adolescent vegetarians comes about because of an adolescent’s impulsivity. Sudden changes in diet for newly converted adolescent vegetarians often are not accompanied by a change in their families’ eating habits. Many families tend to be accepting of their child’s new eating habits, but provisions are not always made to help the child receive the nutrition that he or she needs. The new vegetarian adolescent described in the case reports eating “side dishes” at the family meal. The most common reason for eating only

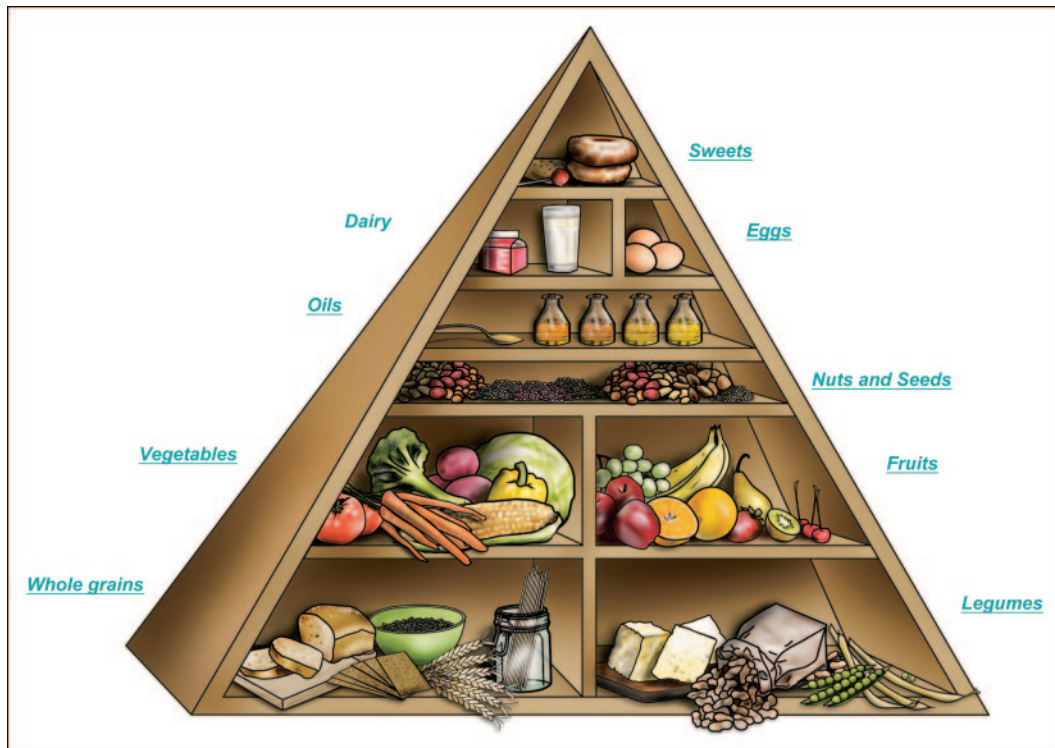


Figure 2. Vegetarian Food Guide Pyramid, depicting the specific food groups that may be included in a vegetarian diet along with the appropriate food proportions for each food group. The Dairy, Eggs, and Sweets categories are optional. Modified from Haddad et al. (15)

“side dishes” is that the main dish usually is an animal or fish product. Many families assume that their vegetarian child is going through a phase and soon will return to a meat-based diet.

Although most adolescents no longer depend solely on their families for food, it still is important to educate

parents and siblings about vegetarianism and available resources (Table 3). Families should not be expected to change their eating habits, but it is important that appropriate foods be available for the vegetarian child. Well-informed parents can guide vegetarian adolescents who are having difficulty adapting to their new dietary restrictions. Vegetarian adolescents commonly eat foods out of convenience, such as pasta and bagels. It is important to stress that these foods may be meatless, but they do not provide adequate nutrition. It also is important to stress that adolescent vegetarians need to be aware of nutritional information for preprepared vegetarian meals. Vegetarians often have the misconception that certain foods must be healthy because they contain products such as tofu or tempeh. As with any food, assessing nutritional information concerning fat, sodium, calories, and sugar is important.

### Potential Disorders in the Adolescent Vegetarian

An important point that often can be the most difficult to elicit is whether an adolescent’s choice to be a vegetarian is a form of restriction. Is it possible that vegetarianism

#### Table 3. Available Resources

United States Department of Agriculture MyPyramid.gov
Local Farmers' Markets <a href="http://www.ams.usda.gov/farmersmarkets/">http://www.ams.usda.gov/farmersmarkets/</a>
Vegetarian Resource Group <a href="http://www.vrg.org">www.vrg.org</a>
Vegetarian Children and Adolescents <a href="http://Vegetarianteen.com">Vegetarianteen.com</a>
Vegetarian Restaurants Around the World <a href="http://Vegdining.com">Vegdining.com</a>

could be disguising an underlying eating disorder? A recent study of adolescents in Minnesota showed that adolescent vegetarianism may be a red flag signaling underlying issues of unhealthy attitudes and weight control. Interestingly, the youth in this study cited wanting to lose or not gain weight as their primary reason for being vegetarians. (13)

This study also found several “sex/vegetarian-status interactions.” Male vegetarians were much more likely than nonvegetarian males to be overly concerned about weight and body image. Adolescent vegetarian males warrant additional screening and counseling to ensure that their dietary choices are not concealing a larger issue.

Another interesting distinction was found between semivegetarians (those who eat fish and chicken) and restricted vegetarians (those who eliminate meat and fish). Restricted vegetarians were more likely to have healthful attitudes toward weight issues, and they also were more likely to engage in physical activities. They appeared more secure and had followed a vegetarian diet for at least 2 years. Semivegetarians commonly had inconsistent eating patterns and harmful weight control measures. (13)

Although adolescent vegetarianism can be a marker for an underlying disorder, it is important to remember that adult vegetarianism is associated with many health benefits. It is important for physicians to teach adolescent vegetarians how to eat in a healthy manner so they can benefit from the positive health effects that have been documented so strongly in their adult counterparts.

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## Summary

Vegetarian diets can provide appropriate and adequate nutrition for all stages of life. The key to success is accurate information and understanding of the subject matter. Because vegetarianism is a complex issue influenced by many different factors, it can be difficult to stay well informed. Numerous studies have shown several important health benefits for adult vegetarians. The job of pediatricians is to ensure that their pediatric patients reap the same health benefits as adults.

- Based on strong research evidence, breastfeeding vegetarians should ensure that they are consuming adequate amounts of vitamin B<sub>12</sub>, folate, and omega 3 fatty acids. (4)(5)(6)
- Based on strong research evidence, vegetarian children raised on a varied diet have normal growth and development measures. (7)(8)(9)(10)(11)(12)(16)
- Based on strong research evidence, adolescent vegetarians choose vegetarianism for very different reasons than their adult counterparts, and their decision often is impulsive and without much forethought. (13)(14)
- Based on strong research evidence, a food guide pyramid that is specific to vegetarians and takes into account the many subtleties of vegetarianism is important when counseling vegetarian patients. (15)
- Based on strong research evidence, vegetarianism in adolescents can be a means of concealing an underlying eating disorder. (13)

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# Treatment of Eating Disorders in Children, Adolescents, and Young Adults

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

1. Describe the demographics and pathogenesis of eating disorders.
2. Delineate the criteria for the diagnosis of anorexia and bulimia nervosa.
3. Detect the presence of an eating disorder and evaluate its severity.
4. Outline the medical complications of eating disorders.
5. Organize a treatment or referral plan for patients who have eating disorders.

## Introduction

A 16-year-old girl who initially was underweight has been dieting and lost 20 pounds in the last 3 months. A 19-year-old girl has been sent home from college because she was found vomiting every night in her dormitory room. A 14-year-old boy has been exercising 3 hours a day and eliminated all fat from his diet to “increase my muscle mass and decrease my fat.” An 11-year-old girl has grown 2 inches but gained no weight since her last check-up 1 year ago. A 15-year-old girl is found to have empty boxes of laxatives hidden under her bed but denies they are hers.

In January 2003, the American Academy of Pediatrics (AAP) published a policy statement entitled “Identifying and Treating Eating Disorders.” Written by the Committee on Adolescence, it outlined the roles of the pediatrician in the identification, evaluation, and management of eating disorders in children, adolescents, and young adults. The statement provided recommendations for treatment in outpatient, inpatient, and day programs and suggested roles for the pediatrician in the areas of prevention and advocacy. Also included were some specifics relevant to particular recommendations, but not a detailed overview of the topic. This article provides that overview and, together with the policy statement, offers a state-of-the-art review of the eating disorders anorexia nervosa and bulimia nervosa. Included in this review are discussions of diagnosis and demographics; pathogenesis and presentation; evaluation and complications; medical, nutritional, and psychological management; and prognosis and prevention. It is expected that pediatricians will use the information in this review to hone their skills in identifying, evaluating, and managing the types of patients presented in the opening paragraph, thus improving the prognosis for children, adolescents, and young adults who have eating disorders.

## Demographics and Diagnosis

Behaviors simulating those seen in current eating disorders go back to the bingeing and purging seen in ancient Rome and the fasting and exercise reported among ascetics in the Middle Ages. The term “anorexia nervosa” was used first in England in the 1880s to describe those who willfully decreased their eating and lost excessive weight; the term “anorexia hysteria” was used in France. Isolated cases were reported through the first half of the twentieth century, with a significant increase in cases beginning in the 1960s. This increase was noted principally among adolescents and young adults and has been considered an outgrowth of changing cultural norms in the ways that women’s shapes and sizes are viewed. Increases in economic and social choices available to women at that same time also may have played a role. The term “bulimia” was introduced in 1979 to describe the bingeing and purging behaviors that were becoming more prominent in individuals who had eating disorders, some of whom were of normal weight or overweight. Those behaviors previously were considered simply to be a part of anorexia nervosa. More

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recently, a new diagnosis, binge eating disorder, has been put forth to describe individuals, most of whom are very overweight, who binge but do not purge. This diagnosis is not yet officially defined as a separate eating disorder. Although binge eating disorder may have its antecedents for some individuals during adolescence, it is rarely seen during the teenage years. Binge eating disorder, therefore, will not be included in this review.

Official diagnostic criteria for the definitions of anorexia and bulimia nervosa have been established by the psychiatric community and are published in the *Diagnostic and Statistical Manual for the Mental Disorders* (DSM-IV) (Table 1). For anorexia nervosa, key diagnostic criteria are weight loss to more than 15% below ideal body weight (IBW), disturbed body image with a fear of becoming fat or gaining weight, and amenorrhea in postmenarchal females of at least three cycles. For bulimia nervosa, key diagnostic criteria are recurrent episodes of binge eating (as defined in the table) occurring at least twice weekly for at least 3 months; recurrent, inappropriate compensatory behaviors to prevent weight gain (ie, self-induced vomiting or use of laxatives, diuretics, fasting, or hyperexercising); and self-evaluation unduly influenced by body shape or weight. The DSM-IV defines two subtypes of anorexia nervosa (restricting and binge eating/purging) and two subtypes of bulimia nervosa (purging and nonpurging).

From a clinical perspective, two clarifications of these criteria are required. First, no specific calculation of IBW is provided. Although the pediatrician may use various growth tables and charts, a simple mnemonic (females: 100 pounds for 60 inches in height and 5 pounds for each additional inch; males: 106 pounds for 60 inches and 6 pounds for each additional inch) generally works well for estimating IBW in adolescents and young adults. For children or adolescents who are not yet fully grown, it is necessary to look at the individual's growth chart to establish where the weight and height would have been had there been no malnutrition. In the younger age group, a diagnosis of anorexia nervosa can be established without any weight loss if the normal progression of weight and height has been delayed sufficiently. In addition, delayed menarche and primary amenorrhea may be signs of an eating disorder in this age group.

Second, studies have shown that more than 50% of children and adolescents who present with eating disorders to adolescent medicine settings do not meet the full diagnostic criteria for either anorexia or bulimia nervosa, but that such patients require the same treatment approaches and have the same psychological disturbances as those who do meet full criteria. The term Eating

## Table 1. Diagnosis of Anorexia Nervosa and Bulimia Nervosa

### Anorexia Nervosa

1. Intense fear of becoming fat or gaining weight, even though underweight.
2. Refusal to maintain body weight at or above a minimally normal weight for age and height (ie, weight loss leading to maintenance of body weight <85% of that expected, or failure to make expected weight gain during period of growth, leading to body weight <85% of that expected).
3. Disturbed body image, undue influence of shape or weight on self-evaluation, or denial of the seriousness of the current low body weight.
4. Amenorrhea or absence of at least three consecutive menstrual cycles (those whose periods are inducible only after estrogen therapy are considered to be amenorrheic).

#### Types:

**Restricting:** no regular bingeing or purging (self-induced vomiting or use of laxatives and diuretics).  
**Binge eating/purging:** regular bingeing and purging by a patient who also meets the above criteria for anorexia nervosa.

### Bulimia Nervosa

1. Recurrent episodes of binge eating, characterized by:
  - a) Eating substantially larger amounts of food in a discrete period of time (ie, in 2 h) than would be eaten by most people in similar circumstances during that same time period.
  - b) A sense of lack of control over eating during the binge.
2. Recurrent inappropriate compensatory behavior to prevent weight gain (ie, self-induced vomiting, use of laxatives, diuretics, fasting, or hyperexercising).
3. Binges or inappropriate compensatory behaviors occurring, on average, at least twice weekly for at least 3 mo.
4. Self-evaluation unduly influenced by body shape or weight.
5. The disturbance does not occur exclusively during episodes of anorexia nervosa.

#### Types:

**Purging:** regularly engages in self-induced vomiting or use of laxatives or diuretics.  
**Nonpurging:** uses other inappropriate compensatory behaviors (ie, fasting or hyperexercising) without regular use of vomiting or medications to purge.

From American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed, DSM-IV. Washington, DC: American Psychiatric Association; 1994.

Disorder Not Otherwise Specified has been used by the DSM-IV to categorize these patients. Included in this category are: 1) Those who have not yet missed three menstrual cycles or are not quite 15% below IBW. It is important to note that patients who initially are very overweight may be more physiologically compromised without being 15% below IBW than patients who initially are at normal weight and are 15% below IBW. 2) Those who vomit or use laxatives regularly but who do not binge. This finding is much more common in adolescents than in young adults. 3) Children 8 to 12 years of age whose eating disorder behaviors are not driven by a specific fear of gaining weight. Eating disorders in this age group sometimes may be marked by a fear of choking, misinterpretations of nutritional advice, or selective eating and sometimes are referred to as “food avoidance emotional disorders.”

Using official DSM-IV criteria, it is estimated that approximately 0.5% of adolescent and young adult women have a diagnosis of anorexia nervosa and 1% to 3% have a diagnosis of bulimia nervosa. In general, anorexia nervosa more commonly begins in the adolescent age group, and bulimia nervosa more commonly begins in young adults. College-age women are believed to have much more eating disorders behaviors in both categories than are estimated by using the official criteria. Most cases occur in females, with the literature estimating a 10 to 20:1 ratio. A recent increase in cases among males appears to be due to an increased focus on excessive exercise and body building, but it is important to realize that some males may be pushed to engage in unhealthy behaviors because of sports participation without developing the thinking patterns that mark those who develop an eating disorder. In the United States, eating disorders are seen much more commonly in Caucasian and Asian than in African-American or Latino youth, with different cultural attitudes toward body weight and shape suggested to account for this difference. Internationally, eating disorders have been considered more common in developed than in developing countries, but globalization is believed to be closing that gap. The fascinating story of the Island of Fiji, which had no people who had eating disorders for 2 centuries until the appearance of American television programs in the mid-1990s, most exemplifies that change.

### Pathogenesis, Presentation, and Prevention

Who develops an eating disorder and why are not easy questions to answer. It is believed that the pathogenesis of eating disorders is multifactorial, with cultural, individual and family, and genetic/ biochemical factors each

playing roles. Cultural factors in historic, ethnic, and international contexts have been alluded to previously. In the contemporary setting, the role of the media in exacerbating the desire to be thin, causing ever-younger girls (and boys) to go on diets, is much discussed. From a public health perspective, fighting the growing epidemic of obesity without increasing the numbers of cases of eating disorders is a consideration. Individual psychological factors that classically have been considered to play a role in the pathogenesis of anorexia nervosa are the lack of control and self-confidence found in otherwise successful, although somewhat restricted, young women. However, these findings have been less universal as the epidemic has grown to include other, nonclassic personality features. Patients who have bulimia nervosa tend to be more impulsive, especially compared with their more compulsive peers who have anorexia nervosa, and studies have shown associations with ongoing substance abuse and past sexual abuse in some patients who have this disorder. Multiple traits, such as overinvolvement and enmeshment, have been shown over the years in the families of those who have eating disorders, but their role in the pathogenesis of the disorder is not clear.

Cultural, psychological, and family factors may not be sufficient to cause the onset of an eating disorder without the presence of a genetic/biochemical vulnerability. Studies have demonstrated that several psychiatric conditions (including depression, obsessive-compulsive disorder, and addictions), each of which has features that overlap with the eating disorders, are more common in individuals and families who have eating disorders. Although environmental factors may play a role in these associations, it is likely that genetic vulnerabilities, mediated through alterations in biochemical reactions, also may play a role. Multiple hormones are being studied (including, most recently, ghrelin, leptin, and melanocortin), and some genetic loci (including several serotonin receptor genes) are being considered as possible sites of alterations.

The Figure presents one approach to the issues of pathogenesis, presentation, and prevention of eating disorders. Studies have shown that more than 80% of adolescent females, especially in suburban settings, express a desire to lose weight, even though most of these girls are of normal weight or underweight. Among those girls, many start a diet, some complete a diet, and a smaller number diet excessively, either by losing too much weight or by using unhealthy methods. Within this group, some develop an early eating disorder, and if allowed to progress, a relatively small number progress to a fully diagnosed eating disorder. Most of these girls,



Figure. One approach to the progressive pathogenesis of eating disorders.

who fit into the bottom half of the figure, are unlikely to present clinically. They generally are responding to the cultural norms of the times. Prevention of eating disorders for this general population requires a public health approach, and efforts are underway to change the cultural milieu regarding appropriate body size and shape for young women. These efforts are taking place in the schools, including changes in health education classes and the introduction of specific curricula, and in the media, where eating disorder behaviors and appearances are being presented less positively. Controversies exist as to whether these approaches, especially the use of school curricula, are having the desired effect. Clearly, much more study is required.

Those adolescents on the top half of the Figure have distinguished themselves from the general population, responding to more than just cultural cues and presumably being affected by the individual, family, and genetic factors discussed previously. It is these adolescents who present clinically. From both a treatment and prevention point of view, it is crucial to detect the problem as early in the process as possible to prevent progression. If detected early, the individual who has taken a diet too far usually can be prevented from developing an early eating disorder, and the individual who has an early disorder can be prevented from developing the fully diagnosed syndrome. For parents and school personnel, this means acting quickly and decisively on the suspicion of eating disorder behaviors, whether that be excessive weight loss, preoccupation with food or weight, excessive exercise, or behaviors such as vomiting or use of diet pills, laxatives,

or diuretics. For the pediatrician, this means recognizing that these behaviors require attention even if the individual denies their presence or minimizes their significance, as most patients who have eating disorders do. The pediatrician often is in a position to intervene at an early stage in the process. Acting quickly can result in easier treatment and a better prognosis.

## Evaluation

Most patients who have eating disorders and are seen in pediatric settings present with some variation of the themes in the five cases listed at the opening of this article. Evaluation of such patients, regardless of the specific presentation, requires attention to the nutritional, medical, and psychological aspects of the patient's status. A complete history and physical examination, along with selected laboratory tests, are performed to specify the diagnosis, determine the level of severity, and plan the treatment.

The nutrition history focuses on issues of weight, diet, and eating disorder behaviors. Current, previous, and desired weights are determined by using a combination of examination, growth charts, and history from the patient and family. Current diet and exercise, with changes over time, are obtained on history from the patient, along with any use of diet pills, laxatives, diuretics, or ipecac (used by some patients to induce vomiting). Because eating disorder behaviors and even diagnoses may change over time, questions regarding these activities during the past days, weeks, months, and even years may need to be asked to achieve a full understanding of the depth and course of the disorder. Also, information obtained on the history should be confirmed, to the degree possible, by parents (or other relatives and friends) because patients who have eating disorders are not always completely truthful about their activities.

Medical symptoms are explored and a complete review of systems is obtained to determine the presence of symptoms associated with malnutrition (such as constipation and feeling cold or faint), vomiting (such as chest pain or hematemesis), or other medical causes of weight loss (such as headaches, polyuria and polydipsia, or persistent diarrhea). The differential diagnosis of weight loss or vomiting includes a long list of other medical and psychiatric conditions (Table 2). It is crucial to evaluate for these other possibilities whenever there are suggestive symptoms or the eating disorder diagnosis is not completely clear. An original set of criteria for the eating disorders in the 1970s specified that an individual did not have anorexia nervosa if any of the conditions in Table 2 were present. However, some individuals can have an

**Table 2. Differential Diagnosis of Eating Disorders**

**Medical**

- Inflammatory bowel/celiac disease
- Addison disease
- Hypo/hyperthyroidism
- Hypopituitarism
- Diabetes mellitus/insipidus
- Brain tumor
- Occult malignancy

**Psychiatric**

- Affective disorder
- Obsessive compulsive disorder
- Schizophrenia
- Substance abuse
- Paranoid disorder
- Conduct disorder

eating disorder in addition to any of the other diagnoses. Thus, the information in Table 2 serves as a list of both differential diagnoses and possible comorbidities. Patients who have eating disorders and several of the diagnoses listed in Table 2, such as thyroid disorders or inflammatory bowel disease, sometimes manipulate use of their medications to facilitate weight loss, and patients who have some diagnoses, such as diabetes mellitus, have a higher prevalence of eating disorders than the general population.

The psychosocial history obtained from the child, adolescent, or young adult who is suspected of having an eating disorder is aimed at determining both what the individual is thinking and how the individual is functioning. Questions should be asked about body image and why the individual is losing weight or engaging in bulimic behaviors. Ultimately, the diagnosis of an eating disorder must include the finding that a desire to lose weight or fear of weight gain is driving the individual's actions. Signs and symptoms indicative of the psychiatric diagnoses listed in Table 2 should be elicited, either as evidence of an alternate diagnosis or as indicators of comorbidity. Depression is very common among patients who have eating disorders. Obsessions or compulsions may be seen as well. Each of these symptoms can be both a possible cause of the eating disorder or a result of the malnutrition. Suicidal thoughts and "cutting" behaviors, if present, must be taken very seriously. The former requires immediate attention; the latter, which has been seen much more commonly during the past 5 to 10 years, indicates significant distress. For patients who have bor-

derline personality disorder, eating disorder behaviors may be one of several areas of dysfunction. Participation in adolescent health risk behaviors, including substance use and sexual activity, may be more frequent and more problematic for individuals who have eating disorders, especially those who have bulimia nervosa, than in age-matched peers. Functioning within the family, with friends, and at school may be impaired for some individuals who have an eating disorder. Psychosocial distress can be both a cause of an eating disorder and exacerbated by the condition. However, many patients who have an eating disorder may be functioning well in any or all of these spheres despite ongoing dieting or bulimic behaviors.

A limited laboratory evaluation should be performed for all patients who present with an eating disorder to detect possible complications or alternate diagnoses. A complete blood count, metabolic panel, urinalysis, and thyroid function tests (thyroxine [T4] and thyroid-stimulating hormone [TSH]) generally are performed, along with measurement of other hormonal values (luteinizing hormone [LH]/follicle-stimulating hormone [FSH], estradiol, prolactin, and human chorionic gonadotropin, as appropriate in those who have amenorrhea) to detect abnormalities in metabolic, hematologic, hepatic, renal, and endocrine function. Electrocardiography (ECG) is recommended for those who have cardiac symptoms, abnormal electrolyte concentrations, or significant bulimia. Radiographic studies (upper or lower gastrointestinal series, computed tomography [CT] or magnetic resonance imaging [MRI] of the brain) are reserved for those cases in which the diagnosis of anorexia or bulimia nervosa is in doubt and other possibilities (eg, esophageal dysfunction, inflammatory bowel disease, or a brain tumor) need to be considered. Vitamin studies and other indicators of malnutrition generally are not ordered because results usually are normal, and abnormalities are treated readily by improved nutrition. Bone density studies, using DEXA (dual-energy x-ray absorptiometry) technology, often are performed in those who have amenorrhea of greater than 6 to 12 months, although specific use of the findings, other than to provide information and possibly motivation, has yet to be determined.

### Medical Complications

The medical complications associated with eating disorders may be considered in three categories: those caused by the malnutrition of anorexia nervosa, those caused by bulimic behaviors, and those caused by refeeding (referred to as "the refeeding syndrome" in its most extreme

form). Some complications may appear as symptoms experienced by the patient, some may be found on physical examination, and others may be detected on laboratory, ECG, or radiographic studies. Findings overlap in anorexia and bulimia nervosa. Some complications are very common; others are encountered rarely. Most of the findings are apparent either on presentation or can appear during the course of the illness or treatment. Knowledge of the abnormalities in all of the organ systems affected by each of the eating disorders is crucial to the medical evaluation.

### Metabolic Abnormalities

Most patients who have an eating disorder have normal results on metabolic panels. However, significant electrolyte disturbances, requiring immediate attention, can be found in patients who have anorexia nervosa or bulimia nervosa and during refeeding. Patients who have anorexia nervosa may drink too little fluid (to make their weight as low as possible) or too much fluid (to fool the treatment team when they are weighed), thereby causing hyper- or hyponatremia. In rare cases, hyponatremia may be sufficiently severe to cause seizures. Both the vomiting and the laxative or diuretic abuse associated with bulimia nervosa can result in a hypochloremic, hypokalemic, metabolic alkalosis, which can be most severe in individuals who participate in both behaviors and can, in rare cases, result in sudden death. Determination of electrolyte levels, therefore, is crucial in the initial evaluation and at appropriate intervals in all patients who have an eating disorder, especially those who have bulimia nervosa. Rapid refeeding of those who are severely malnourished can result in hypophosphatemia, which can lead to cardiac, neurologic, and hematologic complications. Hypophosphatemia is caused by extracellular-to-intracellular shifts of phosphorus in a state of total phosphate depletion. Refeeding also can cause the development of edema, as can too-rapid replenishment of fluids or abrupt cessation of laxative or diuretic use. Long-term dehydration or laxative or diuretic use can result in the development of renal stones.

### Cardiac Abnormalities

Bradycardia and hypotension, accompanied by orthostatic changes, are common findings in anorexia nervosa, serving as criteria for hospitalization if sufficiently severe (Table 3). A prolonged QT interval is rarer, but has life-threatening implications, and a pericardial effusion can be seen in hospitalized patients who are severely malnourished. Various ECG abnormalities may be found in those who have bulimia nervosa, with two fatal cardiac

## Table 3. Criteria for Hospital Admission for Eating Disorders

### Anorexia Nervosa

- <75% ideal body weight or ongoing weight loss despite intensive management
- Refusal to eat
- Body fat <10%
- Heart rate <50 beats/min daytime, <45 beats/min nighttime
- Systolic pressure <90 mm Hg
- Orthostatic changes in pulse (>20 beats/min) or blood pressure (>10 mm Hg)
- Temperature <96°F (35.6°C)
- Arrhythmia

### Bulimia Nervosa

- Syncope
- Serum potassium concentration <3.2 mEq/L (3.2 mmol/L)
- Serum chloride concentration <88 mEq/L (88 mmol/L)
- Esophageal tears
- Cardiac arrhythmias, including prolonged QTc
- Hypothermia
- Suicide risk
- Intractable vomiting
- Hematemesis
- Failure to respond to outpatient treatment

From American Academy of Pediatrics. Committee on Adolescence. Identifying and treating eating disorders. *Pediatrics*. 2003;111:204–211.

complications being of most concern: sudden cardiac death due to hypokalemia and the development of an irreversible cardiomyopathy that can occur suddenly from ipecac use. Cardiac failure also can occur as part of the refeeding syndrome.

Pulmonary complications, in contrast, are uncommon in the eating disorders, with the exception of the rare case of aspiration pneumonia or pneumothorax caused by forceful vomiting by patients who have bulimia nervosa.

### Gastrointestinal Abnormalities

Most patients who have eating disorders have gastrointestinal signs and symptoms at some point during the illness, with most of those problems being more bothersome than dangerous. Patients who have anorexia nervosa often complain of abdominal pains and constipation during either the starvation or refeeding phase. Studies have shown delayed gastric emptying and prolonged peristalsis to be associated with malnutrition. Vomiting frequently results in esophageal irritation and chest pain.

However, the individual who denies that the vomiting is purposeful should prompt consideration of other diagnoses, and the individual who reports emesis should cause consideration of the infrequent Mallory Weiss tears or the rare esophageal rupture. Erosion of tooth enamel may be seen on dental examination in patients who vomit regularly. Some patients may develop calluses on their knuckles (known as Russell sign) from biting down on their fingers when they vomit. Other findings can include gallstones, seen occasionally in those who have lost large amounts of weight, and liver enzyme abnormalities, seen most commonly in refeeding. Decreases in enzyme function may result in elevated levels of carotene, which can cause the skin to appear to be bright orange and occurs especially in those who eat many vegetables and salads. Cholesterol levels also can be elevated, which is surprising in those who have malnutrition, but albumin levels almost always are normal in patients who have an eating disorder. In fact, a low albumin level should prompt a search for other diagnoses, such as inflammatory bowel disease.

### Neurologic Abnormalities

As noted previously, seizures can occur in those who have anorexia nervosa and create a state of hyponatremia by overloading fluids. Also, a peripheral neuropathy, which responds rapidly to refeeding, can be seen in those who lose large amounts of weight relatively rapidly. CT and MRI studies show atrophy of brain tissue in those who are significantly malnourished. The implications of these findings on short- and long-term neurocognitive functioning are being studied.

### Endocrine Abnormalities

In response to insufficient availability of energy, thyroid function is decreased centrally in patients who have anorexia nervosa, resulting in a lowered temperature, pulse, metabolic rate, and ECG voltage. T<sub>4</sub> and TSH values generally are in the low-normal range, with T<sub>3</sub> often being below normal because of a “euthyroid sick syndrome” that decreases conversion of reverse T<sub>3</sub> to T<sub>3</sub>. Other hormonal abnormalities include slight increases in cortisol production, with loss of diurnal variation; increased growth hormone, but decreased somatomedin; and decreased vasopressin activity, at times resulting in polyuria. Most importantly, LH/FSH and estrogen levels are decreased, resulting in amenorrhea, a hallmark of the illness. Amenorrhea can play a major role in the development of osteopenia and, ultimately, osteoporosis in many patients who have anorexia nervosa and some patients who have bulimia nervosa. Studies have demon-

strated that adolescence is the time of life during which the greatest gains in bone density are achieved, that patients who have amenorrhea due to an eating disorder have a loss of bone density, and that all patients who have prolonged amenorrhea (>2 to 2.5 y) develop either osteopenia (defined as bone density >1.0 SD below normal) or osteoporosis (>2.5 SD below normal), regardless of how far above the mean their bone density was genetically determined to be before the onset of the eating disorder.

### Hematologic/Immunologic Abnormalities

Mild anemia is common in those who have anorexia nervosa due to deficiencies in folate or iron, but severe anemia is rare, especially because amenorrhea tends to protect against the development of significant iron deficiency. The erythrocyte sedimentation rate generally is low in anorexia nervosa, white blood cell counts generally are low with malnutrition, and platelet counts occasionally may be decreased with severe malnutrition. Multiple immunologic markers, most notably the interleukins, are altered in anorexia nervosa, but no specific clinical implications have been determined. In fact, anecdotal evidence suggests that patients who have anorexia nervosa have fewer upper respiratory tract infections than others, perhaps because the immune system is placed in a state of alert by the malnutrition.

### Treatment

The AAP position paper produced in 2003 outlines the types of treatment required for patients who have eating disorders based on level of severity. For those who have the mildest cases that respond easily to treatment, management can be provided locally by the pediatrician along with a nutritionist or a mental health professional (psychiatrist, psychologist, or social worker, as needed and available). More severe or intractable cases require outpatient management by an eating disorders treatment team. Some patients may benefit from more intensive care plans (referred to as intensive outpatient, day treatment, or partial hospitalization programs) that are provided several days or evenings per week. Others require inpatient treatment on a medical or psychiatric unit. Details of which patients require each of the available levels of care, along with insurance and advocacy issues, are provided in the position paper.

### Medical Therapy

Most of the medical complications of the eating disorders that are due to malnutrition or bulimic behaviors resolve with improved nutrition and cessation of the

bulimic behaviors. Thus, most complications require monitoring, but no specific intervention. However, certain complications, especially those that potentially could be fatal or have long-term effects, require specific attention. Three such complications are electrolyte disturbances and cardiac abnormalities, refeeding syndrome, and amenorrhea and osteopenia.

The importance of monitoring electrolytes, especially in those who have bulimia, cannot be overemphasized because sudden death from hypokalemia is an important medical cause of fatality. A person who has very mild hypokalemia at times can be treated as an outpatient, but most of those who have hypokalemia require hospitalization, and very low potassium levels require careful replenishment in an intensive care unit. Significant bradycardia also is a cause for hospitalization, as are orthostatic changes in pulse and blood pressure. Studies have shown that approximately 10 days of inpatient nutritional replenishment are required to reverse the cardiovascular instability.

Rapid refeeding of patients who are severely malnourished (generally those who are hospitalized and more than 30% to 35% below IBW) can cause hypophosphatemia, which can result in such major complications as cardiac failure, stupor and coma, and hemolytic anemia. This can occur with intravenous, nasogastric, or oral refeeding. Initial replenishment, therefore, must occur slowly, generally starting at 1,000 to 1,600 kcal/d and increasing by 200 to 400 kcal/d. Phosphorous levels should be monitored carefully (daily at first, less frequently after a few days), and use of phosphorous supplementation, either prophylactically or at the first sign of a decreasing phosphorous level, should be considered. The refeeding syndrome also can result in marked edema due to fluid and electrolyte shifts. Therefore, rapid replenishment of fluids also must be avoided.

Because the development of osteopenia and osteoporosis is the one complication of the eating disorders that is known to have irreversible long-term implications, many studies have been undertaken to determine whether there are treatment approaches that can ameliorate the effects of amenorrhea on bone density. To date, these studies have shown that only a return to normal weight, generally within 10% of IBW, along with normal eating and exercise patterns, can bring about a return of menses and a cessation of the bone loss. Periods can return immediately when some patients achieve a normal weight; others experience a delay of several months before menses returns. Other treatments, including the use of calcium or estrogen supplementation, have not been found to be effective in the prevention of bone loss.

Despite this, some practitioners continue to prescribe hormonal replenishment, generally in the form of oral contraceptives, to amenorrheic patients who have anorexia nervosa. Most specialists, however, do not prescribe hormonal replacement to patients who have an eating disorder, considering it a deterrent to consideration of the return of normal periods as a marker of good health and a motivation to return to normal weight. Studies are underway to examine the possible effects of other medications on bone density, including the bisphosphonates, insulin-like growth factor-1, estrogen, testosterone, and DHEA, but the effectiveness, safety, and practicality of using these medications are yet to be determined.

### Nutritional Therapy

Nutritional rehabilitation is a crucial aspect of treating anorexia nervosa, and nutritional stabilization is an important component of the treatment of bulimia nervosa. Generally, management of medical issues is of immediate concern in the treatment of eating disorders, management of nutritional issues is critical for the short- and intermediate-term course of the eating disorders, and management of psychological issues ultimately is responsible for the long-term outcome of the illness. Three aspects of nutritional management that require attention by the pediatrician are outpatient, inpatient, and behavioral aspects.

For those patients who do not require hospitalization, outpatient nutritional counseling is used to establish weight gain for those who are underweight or weight maintenance for those who are at or have reached a normal weight. For those who need to gain 10 to 20 lb or more, a reasonable rate of expected gain is an average of 1 to 1.25 lb/wk (ie, 4 to 5 lb/mo). Some patients may gain weight more quickly, which is preferable unless it is being accomplished too rapidly or by binge eating. Others may gain more slowly and in uneven fits and spurts. This also can be acceptable, especially in those who do not have as much weight to gain, as long as sufficient progress is being made.

Various methods have been used to achieve weight gain, including calorie counts, exchange systems, preprinted menus, and "common sense" diets, based both on the style of the treatment team and the needs of the patient. Daily diets in the 1,000 to 2,000 kcal range generally are used initially for weight gain, while metabolism is slow and the patient becomes acclimated to eating greater quantities. Diets in the range of 2,000 to 3,000 kcal/d usually are required to continue weight gain beyond the first few weeks. A 3,000 to 4,000 kcal/d

diet may be needed, especially in those who are higher-level athletes. Because individuals typically gain (or lose) 1 to 2 lb/wk if their intake is 3,500 kcal above (or below) maintenance for the week, adding about 500 kcal/day generally is necessary when weight gain is not progressing. Keeping a daily diary and making changes every 1 to 2 weeks based on accomplishment of weight goals, along with monitoring and restriction of exercise as needed, are aspects of the week-by-week nutritional management. Ultimately, when the goal weight is reached, a diet aimed at achieving maintenance is initiated. The goal weight is based both on the patient's previous weights and calculations of IBW for age, sex, and height; a weight within 5% to 10% of IBW often is used because that is a weight at which most patients can achieve the return of regular and normal periods.

Although several of the criteria listed in Table 3 for hospitalization are medical or psychological, the degree of weight loss correlates with medical and psychiatric status and determines the need for hospitalization. Patients who are 20% to 25% below IBW occasionally require hospitalization, those who are 25% to 30% below IBW usually require hospitalization, and those who are more than 30% below IBW almost always require hospitalization. Patients who have bulimia nervosa are hospitalized less commonly, usually if there are electrolyte abnormalities or a pattern that is very out of control. Adolescents who have an eating disorder can be hospitalized on either a medical or psychiatric unit, with several adolescent medicine units that specialize in the treatment of eating disorders available throughout the country. No two units use the same protocols to achieve weight gain for inpatients who have anorexia nervosa. Most units employ oral refeeding for most of their patients, generally including a combination of meals and snacks that begins at 1,000 to 1,600 kcal/d and increases over time to approximately 3,000 kcal/d. Some units use nasogastric tube feeding, liquid diets, or intravenous hyperalimentation more quickly than others. Ultimately, the exact details are less important than the presence of a protocol that is logical, consistent, and includes the possibility of the refeeding syndrome. For pediatricians who must treat a patient who has an eating disorder on a general pediatric or medical unit that does not specialize in the treatment of eating disorders, use of supervised meals and snacks, as outlined previously, can be tried. If consistent weight gain, generally 2 to 4 lb/wk, is not achieved, transfer to a specialized unit is advised.

One area of nutritional management that cannot be overlooked involves the behavioral aspects of care. Because patients who have anorexia nervosa generally do

not want to gain weight, despite whatever statements they may make outwardly, nutritional advice alone usually is not sufficient to bring about weight gain. Ultimately, patients who have an eating disorder must be made to understand that they have no choice about gaining weight. Often, the pediatrician is forced to set the parameters. For patients who are close to a weight for which hospitalization is required, goal weights can be established by which hospitalization can be avoided (sometimes referred to as "weights and dates"). Goal weights always should be higher than current weight and never lower because most patients tend to go to the lowest weight they are allowed. In essence, patients are told that they no longer have a choice *whether* to gain weight but still do have a choice *where* to gain weight (at home or in the hospital). Once they are admitted to the hospital, they no longer have a choice *where* to gain weight but only *how* to gain weight (oral feeding or other methods). For patients whose weight loss is less severe, other behavioral interventions (the use of positive or negative reinforcements) may be required. Restriction of physical activity can serve this purpose, but other restrictions (important enough to matter to the patient but not so important to have a negative impact on life) may need to be used. These behavioral motivations are not considered to be treatment of the eating disorder per se but rather serve as an important means for other aspects of treatment to move forward.

### Psychological Therapy

Although the counseling and behavioral management provided by pediatric practitioners can be considered an important component of the psychological treatment offered to patients who have eating disorders, most patients also require the more intensive approaches provided by mental health practitioners (including social workers, psychologists, or psychiatrists). Individual therapy is the mainstay of mental health care, aiming at understanding both why the individual has developed an eating disorder and how to handle its ramifications. Individual therapy may not be as effective when a patient is severely malnourished or for young adolescents, and standard interpersonal therapy may not be as effective in some situations as newer approaches, such as cognitive-behavioral therapy. Family therapy can be particularly important for adolescents. Group therapy sometimes is used as an adjunct, especially in college settings, although there are concerns about the "contagion effect" it can engender. Ultimately, the ability of a patient and family to benefit from therapy reflects the degree of

underlying difficulties and bears directly on the course and outcome of the illness.

Psychotropic medications are used increasingly to treat eating disorders, although with some controversy during the past few years. Studies have shown that antidepressant medications in the selective serotonin reuptake inhibitor (SSRI) class, such as fluoxetine, affect the frequency of binge eating and purging by patients who have bulimia nervosa. This probably is a direct effect, although it may be mediated through a decrease in the level of depression. SSRIs have not been shown to affect weight gain of patients who have anorexia nervosa. They are used frequently, however, to treat the depression and anxiety that often accompany the eating disorders. Some studies have shown that SSRIs may decrease the relapse rate in anorexia nervosa once weight goals have been achieved. Questions have been raised about whether SSRIs precipitate suicidal behaviors in children and adolescents who are depressed, prompting the need for extra caution with their use in the treatment of eating disorders in these age groups. Of late, the use of atypical antipsychotics has shown some benefits for patients who have recalcitrant anorexia nervosa, and some antiepileptic drugs are being used to decrease binge-eating episodes by patients who have bulimia nervosa.

## Course and Outcome

The short-, intermediate-, and long-term outcomes for patients who have eating disorders are variable, and no indicator provides a specific prognosis for any individual case. In the short-term, it should be possible to reverse weight loss in almost every patient who has anorexia nervosa, even those who are exceedingly difficult to manage, as long as the appropriate outpatient and inpatient programs are available, the family is supportive of treatment needs, and the family's insurance company does its part. Whether initial weight gain is accompanied by necessary changes in "mood, food, and attitude" depends on underlying factors within the individual patient. For patients who have bulimia nervosa, both short- and intermediate-term outcomes depend on individual factors. Appropriate treatment gives bulimic patients an improved chance of controlling their behaviors, but the more coercive approaches used to accomplish weight gain in anorexia nervosa cannot be used as effectively to decrease harmful behaviors for those who have bulimia. Studies have not demonstrated the superiority of any specific approach in the treatment of anorexia nervosa, and medications and several different types of therapy have been associated with similar results in the treatment of bulimia nervosa. Several factors related to illness

length and severity long have been considered prognostic factors in anorexia nervosa; more recently, weight on discharge from the hospital has been evaluated as a predictor of relapse in patients who have anorexia nervosa.

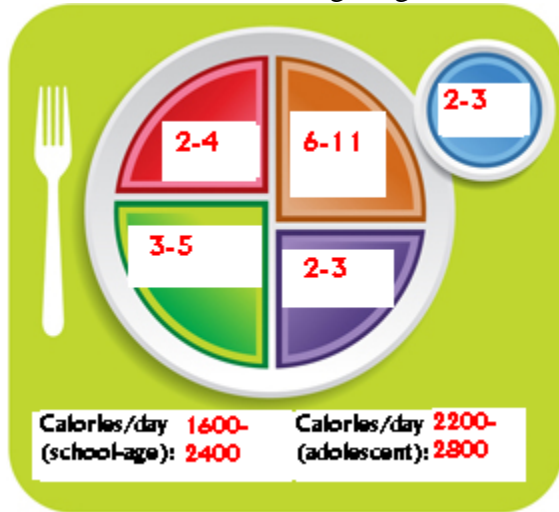
The long-term outcome of anorexia nervosa has been evaluated in more than 100 studies during the past 4 decades. These studies have shown that approximately 50% of patients do well over time, approximately 30% do reasonably well but continue to have symptoms, and approximately 20% do poorly. A mortality rate of 5% to 10%, due to either suicide or medical complications, has been reported in the longer-term studies, representing among the highest mortality rates of all psychiatric disorders. These outcome data demonstrate how significant the eating disorders are for long-term health and well-being. Some indications in the literature, however, suggest that the prognosis in adolescents, especially those who are treated successfully as outpatients, is better. Furthermore, it appears that early and aggressive treatment in adolescence has a strongly positive affect on prognosis. Thus, it is incumbent on pediatric practitioners to detect, treat, and refer patients who have an eating disorder as quickly as possible to promote the best possible outcome in this often difficult and long-lasting disease.

## Suggested Reading

- American Academy of Pediatrics. Committee on Adolescence. Identifying and treating eating disorders. *Pediatrics*. 2003;111:204–211
- American Psychiatric Association. *Diagnostic and Statistical Manual of Mental Disorders*. 4th ed. Washington, DC: American Psychiatric Association; 1994
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## Nutrition Quiz—Part II

1. Please fill-in the serving ranges for the “Food Plate” of an early-to-middle adolescent:



Remember—these are recommended range and not “absolute rules”.

2. What are the most common nutritional deficiencies in vegetarians and how do they present?

- Vitamin B12: aid in growth and development of brain and nervous system; in older children and adolescents, may present as megaloblastic anemia.
- Folate: aid in growth and development of brain and nervous system; in older children and adolescents, may present as megaloblastic anemia.
- Omega-3-fatty acid: assist in brain and retinal development; in older children and adolescents, may present as fatigue, poor memory, dry skin, mood swings or depression, and poor circulation.

*Other important vitamins/minerals* that may be lacking in the vegetarian diet are protein (malnutrition—kwashiorkor & marasmus in extreme state); iron (anemia); calcium (osteopenia); and zinc (hair/skin/nail changes).

3. Please match the following metabolic complications, with the primary causative factor:

- A. hypernatremia, hyponatremia
- B. hypophosphatemia
- C. hypoCl, hypoK metabolic alkalosis

- 1. Caused by malnutrition of AN: A
- 2. Caused by bulimic behaviors: C
- 3. Caused by refeeding syndrome: B

4. Among anorexic patients, approximately 50% do well over time, 30% continue to have symptoms, and 20% do poorly. The mortality rate is 5-10%, due to either suicide or medical complications—the highest rates of all psychiatric disorders.

## Nutrition Cases—Part II

### Case I:

Abby, a 17-year old previously healthy female, presents in clinic for evaluation of secondary amenorrhea x 4 months. In the course of your interview, you find that although her body weight today in clinic is 90% of her ideal body weight, she continues to desire to lose weight. Review of her 24-hr diet history reveals adequate caloric intake, but she endorses swimming twice per day for two hours each session at the local swim club. Before the prom last spring, she took OTC laxatives in order to “look good in her dress.” Her vitals upon presentation are HR 56, RR 20, BP 106/77, AF.

**This patient is 5’6”. What is her ideal body weight?**

100 lbs per 60 inches = 100 lbs

5 lbs per each additional inch = 5x60 = 30 lbs



<b>IBW = 130 lbs</b>
----------------------

**Can you definitively diagnose her given the information above? If so, what is her diagnosis?**

No (see p.6; Table I of PIR for full DSMIV criteria). Key criteria in chart below:

<b>Anorexia Nervosa</b>	<b>AN</b>	<b>Bulimia Nervosa</b>	<b>BN</b>
Wt loss to >15% below IBW	No	Recurrent bingeing: 2x/wk x 3mo	No
Amenorrhea x 3 cycles	Yes	Recurrent compensatory behaviors	Yes?
Disturbed body image; fear of gaining wt	Yes?	Self-evaluation α body shape, weight	Yes?

Patient may fit better in **Eating Disorder-NOS:**

- (1) Haven’t missed 3 cycles; **aren’t >15% below IBW**
- (2) **Vomit or use laxatives, but don’t binge**
- (3) 8-12 years old with “food avoidance emotional disorder”

**Would you admit this patient to the hospital? Why or why not?**

No. (See p. 10; Table 3 for admission criteria). Based on the given info, she meets no criteria.

### Anorexia

- <75% IBW or ongoing weight loss despite Rx
- Refusal to eat
- Heart rate <50 daytime, <45 nighttime
- SBP <90 mm Hg; Orthostatic changes
- Arrhythmia

### Bulimia

- Failure to respond to outpatient treatment
- Intractable vomiting; Esophageal tears
- Suicide risk
- K <3.2; Cl <88
- Cardiac arrhythmias; Syncope

**At WRNMMC-B, what are this patient’s options for treatment?**

A multidisciplinary team approach is necessary, to include a medical provider (i.e. YOU), a therapist (consult Behavioral Health/CAPS), and potentially a nutritionist (consult Cheryl Issa).

The role of the medical provider is first to rule out any medical complications, and second to follow the patient’s weights diligently, as well as long-term issues such as menses and bone health. Adolescent Medicine is available for consultation to serve this role, if you desire.

If inpatient treatment is necessary (see criteria above), consider Sheppard Pratt or CNMC. You will need to work with our new clinic social worker (Ms. Norma Dabbs) or case management/ HealthNet to coordinate an inpatient admission. Occasionally, a patient may be admitted to *our* inpatient ward (3W) on a short-term basis, either if the diagnosis is uncertain or if there are emergent medical complications that must be addressed immediately.

## **Case II:**

HM3 Smith presents with his pregnant wife and 2 sons—ages 4 and 10—and 1 daughter—age 13—for their school physicals. In taking a dietary history, you learn that the 13 year-old has decided to become “vegan”, after watching [“The Vegan Challenge” episode on Oprah](#). She also DVR’d the episode for her mother and convinced her to start cooking vegan for the entire family. Mrs. Smith proudly reports that, for the last 6-months, the entire family has been eating vegan (like Oprah!), and she has noticed that she and her children have been healthier and more energetic as a result. HM3 Smith, who has been missing his steak dinners, asks you to explain to his wife and strong-willed 13-year-old why a vegan diet is unhealthy.

### **What is eliminated in a vegan diet versus a vegetarian diet?**

**Vegan diets eliminate ALL animal and fish products, to include eggs and dairy.** Lacto-vegetarians include milk products. Lacto-ovovegetarians include milk and egg products. Semi-vegetarians include poultry and fish.

**Can you make an argument to support Mrs. Smith? What are the benefits of a vegan or vegetarian diet?** Studies have shown that when “well-informed” parents raise vegetarian children, their growth parameters compare with that of non-vegetarian children. In addition, they tend to be leaner, with lower relative body weights and skin-fold thicknesses. Studies show that children and adolescents who follow a vegetarian diet have a lower intake of cholesterol, saturated fat, and total fat and a higher intake of fruit, vegetables, and fiber than their non-vegetarian counterparts. Vegetarian adults have a decreased risk for several chronic diseases such as diabetes, coronary artery disease, hypertension, obesity, and some types of cancer.

HM3 Smith seems even more distressed by this explanation. To diffuse the situation, you ask the others to step out the room, so that you can do your HEADSS exam for the 13-year-old.

### **Regarding her choice to become vegan, what sorts of questions and counseling do you want to address to this adolescent?**

- Understand the adolescent’s reason for a vegetarian diet, recognizing that the rationale may be ideological rather than health-related, including: ethical opposition to killing animals; disgusted by animal processing; and influence of friends.
- Evaluate weight concerns, body image, frequency of dieting for weight loss, and exercise patterns (a vegetarian diet may be an attempt to camouflage an eating disorder)
- Assess knowledge base and provide targeted education, including how to read food labels and *healthy* vegetarian options at school or out with friends.
- Recommend supplementation as necessary with calcium and vitamin B12

The 13-year-old reassures you that her reasons for becoming vegan were due to Oprah—and not an underlying eating disorder. You complete the remainder of her HEADSS and physical exam, and you nervously invite the rest of the family back into the room. After examining the 4-year-old and 10-year-old, HM3 Smith asks you to provide his wife with guidance for the younger children, “since she insists on this vegan nonsense”.

**What guidance would you give for the toddler and school-age Smiths? What guidance would you give for Mrs. Smith, as she anticipates the arrival of Baby #4?**

Toddler/preschool

- Assess vegan/vegetarian food availability at day care
- Ensure healthy and frequent snacks with a variety of energy-dense, low-bulk foods
- Evaluate calcium, B12, folate, iron, and zinc sources
- Review choking hazard with nuts and vegetables

School age

- Assess school lunch availability of vegetarian options
- Discuss food choices and alternatives with friends/activities
- Provide guidance to parents and reassurance to child that this may be the first time the child learns the diet is considered “alternative”
- Supplement as needed for calcium, B12, folate, iron, and omega-3 fatty acids.

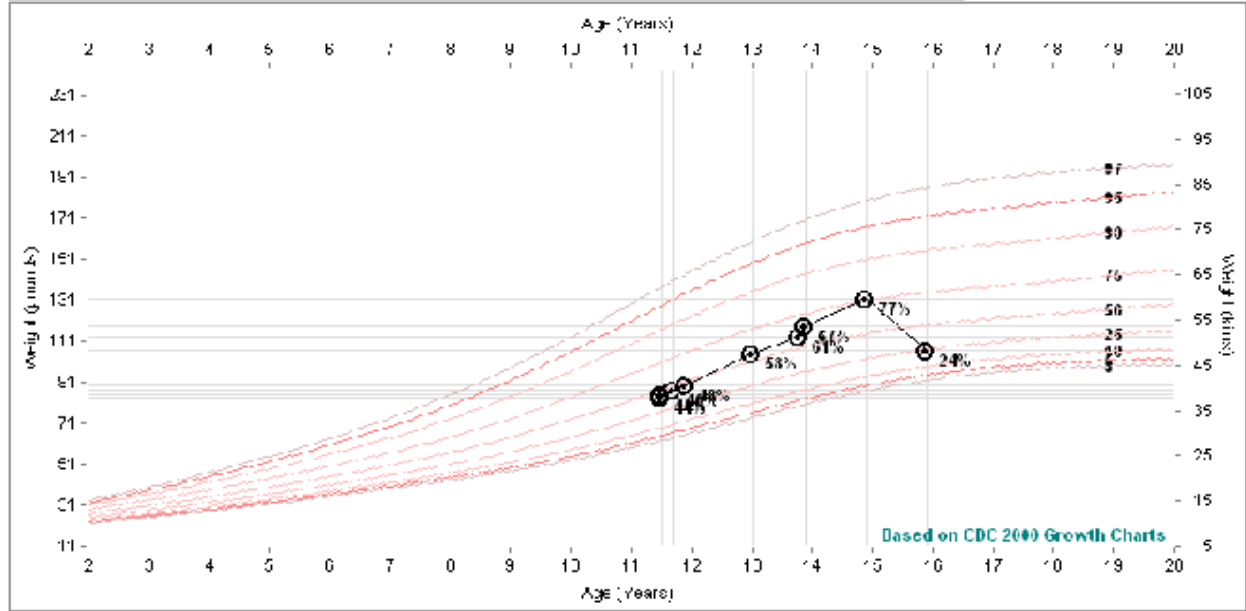
Infants

- Supplement with B12 for breastfed infants, if mother is not supplementing her diet or is not consuming food with adequate B12
- Recommend vitamin D supplementation if the infant is exclusively breastfed
- Review introduction of solids with protein-rich foods: pureed tofu, pureed legumes, soy yogurt
- Full-fat fortified soy milk may be used at age 1 year or older

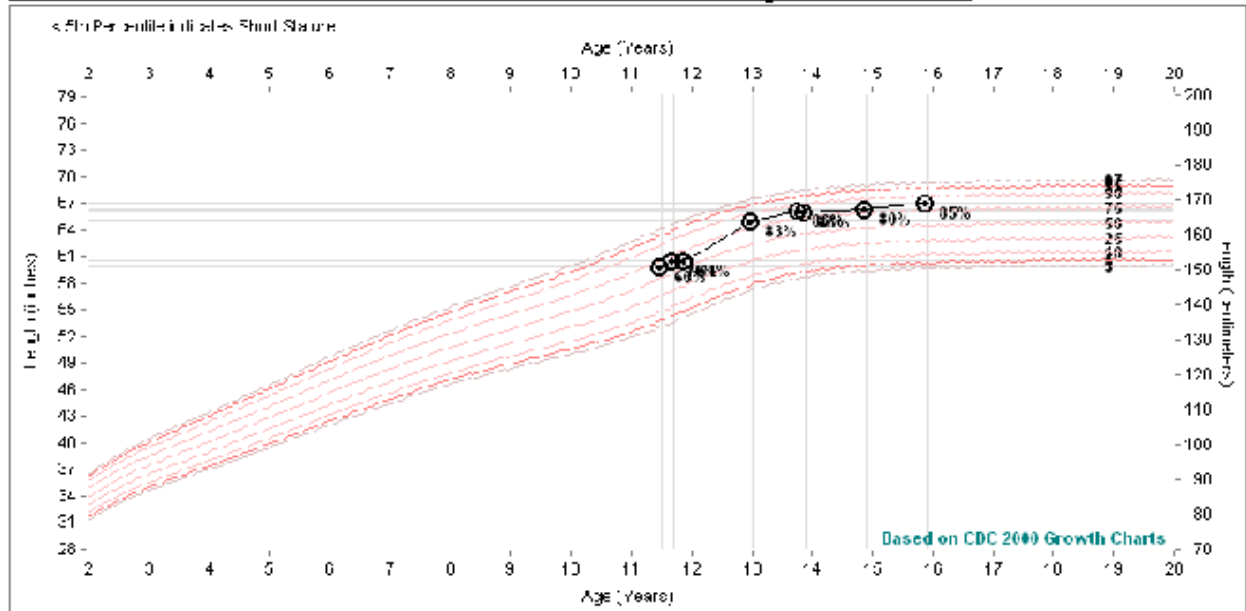
**Extra-Case III: Flashback to Growth Charts**

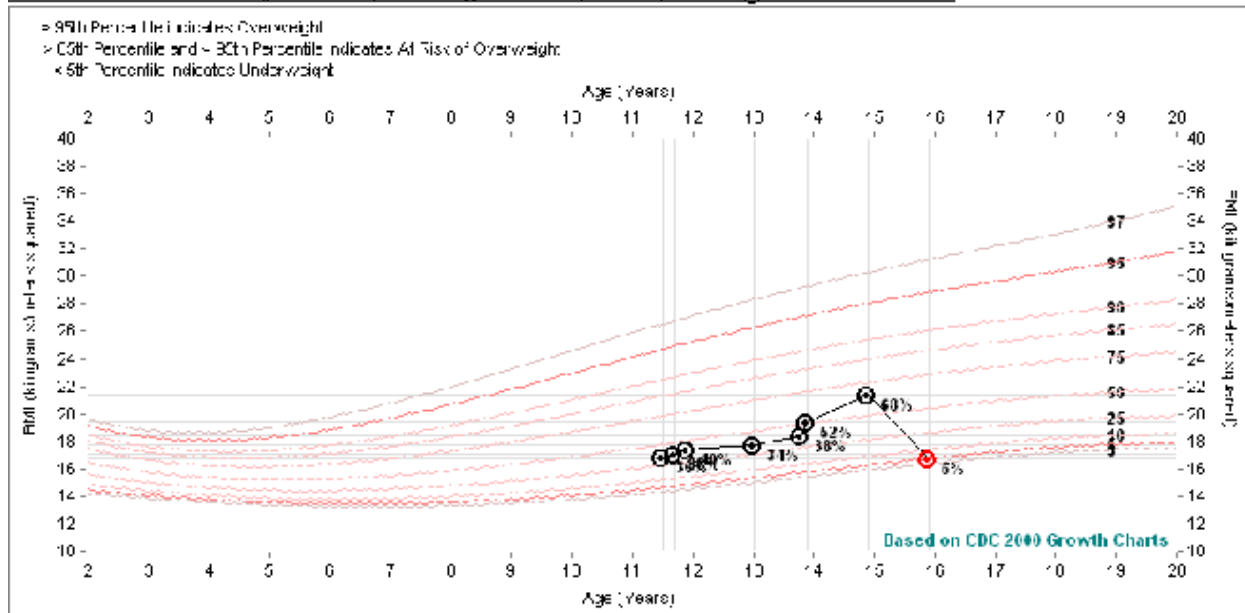
Marie, a 15 year-old female with PMHx of anxiety disorder, presents for a school physical. Your nurse kindly imports her growth-charts to your AHLTA note prior to your exam. Based on these growth charts alone, please answer the questions below:

**Growth Chart 24 months-20 years: Girls, Weight vs Age** Written by PERRY,RUTH C @ 15 Jul 2010 1434 EDT



**Growth Chart 24 months-20 years: Girls, Stature vs Age** Written by PERRY,RUTH C @ 15 Jul 2010 1434 EDT





**What is your differential diagnosis?**

Based on the patient's age and comorbidity (i.e. anxiety disorder), without any additional history, an eating disorder may be most likely. However, it is important to first rule-out the following organic causes of weight loss: Inflammatory bowel/ceeliac disease; Addison disease; Hypo/hyperthyroidism; Hypopituitarism; Diabetes mellitus/insipidus; Brain tumor; Occult malignancy.

**What initial studies and laboratory tests will you order?**

See p.8 of PIR article for full evaluation guidelines.

Definite labs: CBC, CMP, U/A, TFTs

Labs to consider: LH, FSH, E2, PRL, hCG, pre-albumin

Labs to avoid (?): vitamin levels (usually normal)

Rads to consider: UGI or LGI (if esophageal dysfunction or IBD in ddx); CT or MRI of brain (if tumor in ddx); DEXA (if amenorrhea >6-12mo); ECG (if cardiac sxs, abnl lytes, severe bulimia)

## Nutrition Board Review— Part II

1. You are evaluating a 2-year-old daughter of strict vegan parents. Her birthweight at term was 3.5 kg. Since weaning at 12 months of age, the child's diet has included a homemade, macrobiotic-based formula. In your office today, the girl's weight is 11.2 kg.

**Of the following, the child's diet MOST likely is deficient in**

- A. essential amino acids
- B. linoleic acid
- C. vitamin A
- D. vitamin B12**
- E. vitamin C

Strict vegan diets include foods that come solely from plant sources. Such diets generally contain adequate amounts of vitamins A and C as well as essential fatty acids (including linoleic acid). However, a strict vegan diet instituted after weaning contains very little vitamin B12, a nutrient primarily found in meats, eggs, and dairy products, unless supplements are provided.

Breastfed infants of vegan mothers may develop vitamin B12 deficiency, but only if maternal stores are low. Although the vitamin composition of human milk is directly related to dietary intake of vitamins A, C, D, and the B group, studies comparing the vitamin content of human milk from vegan compared with nonvegan mothers have not demonstrated any significant micronutrient differences. Commercial soy-based formulas are alternatives for vegan mothers who do not breastfeed. In most cases, therefore, the greatest potential nutritional risks for both breastfed and soy formula-fed infants of vegan parents occur after weaning. This is particularly the case when a homemade weaning formula is given. Conversely, commercially available soy milks are supplemented with vitamins.

Studies in both the United States and the United Kingdom have shown that vegan children exhibit small but significant differences in growth variables (height and weight percentiles) compared with children eating mixed diets. This observation most likely is the consequence of group differences in total energy consumption, although other studies have demonstrated that the calcium and zinc content of the vegan diet also may be low, indicating the requirement for supplementation.

Conversely, the essential amino acid and total protein intake of vegan children has been shown to be adequate to support normal growth. Despite the lower mean height and weight of vegan children compared with children eating mixed diets, a large British study found no evidence of growth failure (weight or height less than the 5th percentile) in vegan children, and no between-group differences were noted in terms of muscle strength and overall health.

A routine health assessment of any child should include a careful dietary history. Information about specific cultural or family customs permits identification of patients at nutritional risk and aids the clinician in determining whether caregivers require education regarding appropriate nutrition for growing children. For example, in industrialized countries, vitamin D deficiency rickets is an emerging nutritional problem. Such deficiency is particularly prevalent for dark-skinned infants living in temperate or northern climates, those whose cultural/religious customs may include extensive covering of body surfaces, and in infants and children who receive little direct sunlight exposure (ie, less than 30 minutes to the face and hands three times per week).

2. A 7-month-old child presents for a follow-up office visit after undergoing a Kasai procedure for biliary atresia at 6 weeks of age. The mother states that the boy is irritable when his right arm is moved. On physical examination, the infant is jaundiced. You detect tenderness in the anterior radial head. Radiography of the affected region demonstrates metaphyseal fraying and a fracture.

**Of the following, the MOST appropriate laboratory studies to obtain next are**

- A. calcium and phosphorus measurement and bone densitometry (DEXA scan)
- B. calcium and phosphorus measurement and urinary calcium-to-creatinine ratio
- C. calcium, phosphorus, and 25-hydroxyvitamin D measurement**
- D. calcium, phosphorus, and magnesium measurement
- E. magnesium, phosphorus, and parathyroid hormone measurement

Chronic cholestasis due to biliary atresia results in decreased bile flow into the intestine. The absence of intraluminal bile acids, in turn, causes decreased digestion of lipids, leading to fat malabsorption. In addition, absorption of fat-soluble vitamins (A, D, E, and K) is impaired, which may lead to clinical sequelae of fat-soluble vitamin deficiency. Finally, steatorrhea may impair calcium absorption because intraluminal free fatty acids may bind calcium.

The clinical presentation of the patient in the vignette strongly suggests the presence of rickets from vitamin D deficiency. Therefore, the most helpful initial laboratory testing is determination of calcium, phosphorus, and 25-hydroxyvitamin D concentrations. The 25-hydroxyvitamin D assay is the best measure of hepatic stores of vitamin D and is a better marker of vitamin D status than either serum vitamin D or 1,25-dihydroxyvitamin D. Although bone density testing, measurement of serum magnesium and parathyroid hormone, and determination of the urinary calcium-to-creatinine ratio may provide useful additional information, they will not help establish the diagnosis of vitamin D-deficient rickets.

Rickets is a potentially preventable complication of biliary atresia, but requires monitoring of calcium, phosphorus, and 25-hydroxyvitamin D concentrations two to four times a year. Infants who have biliary atresia routinely receive supplementation with approximately 8,000 IU of ergocalciferol (vitamin D2) daily. This dose of vitamin D is approximately 20 times the recommended dietary allowance for a healthy toddler. If rickets develops or the vitamin D concentration cannot be maintained within the normal range, the patient should receive either calcitriol (1,25-dihydroxyvitamin D3) or intramuscular vitamin D.

3. A 12-year-old boy has had cholestasis since infancy from Alagille syndrome. He has been lost to medical follow-up for the last several years. He now presents to your office with pain in his right upper thigh after a fall. His thigh is intensely tender, and ultrasonography demonstrates a large hematoma in his quadriceps. The parents state that he has tended to bruise easily in the past few months.

**Of the following, the condition MOST likely to account for this patient's symptoms is**

- A. factor VIII deficiency
- B. idiopathic thrombocytopenic purpura
- C. vitamin C deficiency
- D. vitamin K deficiency**
- E. von Willebrand disease

Alagille syndrome is characterized by cardiac disease (especially peripheral pulmonary stenosis), vertebral anomalies, ocular anomalies (posterior embryotoxon), facial dysmorphism (triangular facies, macrocephaly, large ears), and paucity of the intrahepatic bile ducts. The hepatic manifestations of this syndrome account for much of the medical morbidity. Specifically, impaired bile flow results in chronic cholestasis, which leads to severe pruritus, jaundice, malabsorption of nutrients, and malabsorption of fat-soluble vitamins. Although most affected children have their jaundice improve as they grow older, a subset progresses to cirrhosis and requires liver transplantation.

Patients who have hepatic disease must have their nutritional status monitored carefully. Chronic anorexia, recurrent illnesses, and fat malabsorption may result in caloric deficiency and growth failure. Caloric supplementation by nasogastric tube or gastrostomy may be necessary to ensure adequate caloric intake. In addition, patients who have cholestasis are at risk for fat-soluble vitamin deficiency.

Vitamin D deficiency typically causes osteopenia and rickets, vitamin E deficiency causes peripheral neuropathy and ataxia, and vitamin A deficiency may cause night blindness or corneal lesions. The bruising described for the patient in the vignette most likely is due to vitamin K deficiency. Vitamin K is a cofactor essential in posttranscriptional carboxylation of the clotting factors II, VII, IX, and X. Thus, vitamin K deficiency leads to prolonged prothrombin and partial thromboplastin time, which predisposes to bruising. Although factor VIII deficiency, vitamin C deficiency, von Willebrand disease, and idiopathic thrombocytopenia purpura also may cause bruising, the patient who has Alagille syndrome is not at increased risk for developing these conditions.

In addition to supplementing patients who have chronic liver disease with fat-soluble vitamins, the clinician caring for these patients also must supply adequate calories. Patients who have advanced chronic liver disease may have both anorexia and increased caloric requirements. In addition, patients who have portal hypertension and ascites may

need to have total fluid intake restricted, which, in turn, means that they may require a more concentrated and less palatable formula. For these reasons, nasogastric or gastrostomy feedings sometimes are necessary to achieve optimal growth, especially when preparing a patient for liver transplantation.

4. A 16-year-old boy in your practice has cystic fibrosis. As a complication of his illness, he has developed cirrhosis and cholestasis. He now complains of shaky hands. Neurologic examination demonstrates hyporeflexia and tremor with hands outstretched.

**Of the following, the patient's symptoms are MOST consistent with deficiency of**

- A. vitamin A
- B. vitamin B1 (thiamine)
- C. vitamin C
- D. vitamin D
- E. vitamin E**

Because the young man described in the vignette has chronic cholestasis, he is at risk for developing deficiency of any of the fat-soluble vitamins, including vitamins A, D, E, and K. His neurologic symptoms of tremor and hyporeflexia most strongly suggest vitamin E deficiency. Vitamin E (tocopherol) is an important factor in stabilizing the lipid membrane of the red blood cell and the lipids in the myelin sheath of neurons. Therefore, the most common presenting features of hypovitaminosis E are hemolysis (primarily reported in preterm infants) and peripheral neuropathy (identified in infants and children who have chronic cholestasis, pancreatic insufficiency, or malabsorption).

Supplementation of formulas and parenteral nutrition with vitamin E has reduced substantially the incidence of hemolysis in the vitamin E-deficient preterm infant. However, patients who have cystic fibrosis or cholestatic liver disease require both monitoring of vitamin E concentrations and supplementation with vitamin E. Because vitamin E is a fat-soluble vitamin, those who have cholestasis may have difficulty absorbing alpha-tocopherol, the form of vitamin E available in most dietary supplements. For this reason, d-alpha-tocopheryl polyethylene glycol 1,000 succinate, a water-soluble form of vitamin E, should be given to patients who have significant cholestatic liver disease. The recommended dose for a patient who has cholestatic liver disease is 15-25 IU/kg/day.

Deficiency of vitamin A, B1, C, or D would not be expected to cause such a clinical presentation. Vitamin A deficiency causes impaired vision ("night blindness") and corneal ulcers; vitamin B1 deficiency can cause myopathy and heart failure ("beriberi"); vitamin C deficiency causes irritability, bone lesions, and bruising (scurvy); and vitamin D deficiency causes osteopenia or rickets.

5. A medical student rotating in your clinic tells you about a 5-month-old infant he has evaluated. He reports that the infant is fed goat milk exclusively and asks you if this is adequate nutrition at this age.

**Of the following, the MOST likely deficiency in this infant is of**

- A. folate**
- B. iron
- C. niacin
- D. vitamin A
- E. vitamin D

Goat milk is used exclusively for infant nutrition in some countries and has been used occasionally in the United States for infants who have cow milk allergies, but its routine use in the United States is not recommended. Although its fat may be digested more easily than fat found in cow milk preparations, it is deficient in several important nutrients, such as iron, vitamin D, and especially folate. Folate is a cofactor required in nucleoprotein synthesis, and deficiency ultimately results in ineffective erythropoiesis and megaloblastic anemia. Macrocytosis and hypersegmented neutrophils are typical findings on complete blood count, and if the anemia is severe, pancytopenia also can occur. Mothers who feed their infants goat milk exclusively should be counseled to switch to cow milk formula to avoid these complications. Niacin and vitamin A are sufficiently present in goat milk to avoid deficiency of these nutrients.