

Cholesterol and Atherosclerosis in Children

AHA Scientific Position

There is compelling evidence that the atherosclerosis (ath"er-o-skleh-RO'sis) (fatty deposits of plaque in artery walls) or its precursors begins in childhood and progresses slowly into adulthood. Then it often leads to coronary heart disease, the single largest cause of death in the United States. Furthermore, there is evidence that

- Elevated cholesterol levels early in life may play a role in the development of atherosclerosis in adults.
- Eating patterns and genetics affect blood cholesterol levels and coronary heart disease risk.
- Lowering levels in children and adolescents may be beneficial.

Many laboratory, clinical, pathological and epidemiological studies have clearly established that high blood cholesterol levels play a role in developing coronary heart disease in adults. Several studies also have shown that fatty buildups in arteries begin in childhood and are more likely with higher blood cholesterol levels.

To reduce fatty buildups in arteries in children (and adults):

- Cigarette smoking should be discouraged.
- Regular aerobic exercise that lasts at least 30–60 minutes on most days of the week should be encouraged.
- High blood pressure should be identified and treated.
- Obesity should be avoided or reduced.
- Diabetes mellitus (di"ah-BE'teez or di"ah-BE'tis meh-LI'tis) should be diagnosed and treated.

Children age 2 years and older should be encouraged to eat at least five servings of fruits and vegetables daily as well as a wide variety of other foods low in saturated fat and cholesterol. Doing this will help them maintain normal blood cholesterol levels and promote cardiovascular health.

Cholesterol levels in children and adolescents 2–19 years old

Category	Total Cholesterol (mg/dL)	LDL Cholesterol (mg/dL)
Acceptable	less than 170	less than 110
Borderline	170–199	110–129
High	200 or greater	130 or greater

HDL levels should be greater than or equal to 35 mg/dL and triglycerides should be less than or equal to 150 mg/dL

The American Heart Association endorses these guidelines of the National Cholesterol Education Program's Expert Panel on Blood Cholesterol in Children and Adolescents.

The American Heart Association recommends this eating pattern for families:

- Energy (calories) should be adequate to support growth and development and to reach or maintain desirable body weight.
- Eat foods low in saturated fat, trans fat, cholesterol, salt (sodium), and added sugars.
- Keep total fat intake between 30 to 35 percent of calories for children 2 to 3 years of age and between 25 to 35 percent of calories for children and adolescents 4 to 18 years of age, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts and vegetable oils.
- Choose a variety of foods to get enough carbohydrates, protein and other nutrients.
- Eat only enough calories to maintain a healthy weight for your height and build. Be physically active for at least 60 minutes a day.
- Serve whole-grain/high-fiber breads and cereals rather than refined grain products. Look for “whole grain” as the first ingredient on the food label and make at least half your grain servings whole grain. Recommended grain intake ranges from 2 oz./day for a one-year-old to 7 oz./day for a 14–18-year-old boy.
- Serve a variety of fruits and vegetables daily, while limiting juice intake. Each meal should contain at least 1 fruit or vegetable. Children’s recommended fruit intake ranges from 1 cup/day, between ages 1 and 3, to 2 cups for a 14–18-year-old boy. Recommended vegetable intake ranges from $\frac{3}{4}$ cup a day at age one to 3 cups for a 14–18-year-old boy.
- Introduce and regularly serve fish as an entrée. Avoid commercially fried fish.
- Serve fat-free and low-fat dairy foods. From ages 1–8, children need 2 cups of milk or its equivalent each day. Children ages 9–18 need 3 cups.
- Don’t overfeed. Estimated calories needed by children range from 900/day for a 1-year-old to 1,800 for a 14–18-year-old girl and 2,200 for a 14–18-year-old boy.

This eating pattern supports a child's normal growth and development. It provides enough total energy and meets or exceeds the recommended daily allowances for all nutrients for children and adolescents, including iron and calcium.

Table: Dietary Recommendations for Children

Daily Estimated Calories and Recommended Servings for Grains, Fruits, Vegetables, and Milk/Dairy by Age and Gender

	1 Year	2–3 Years	4–8 Years	9–13 Years	14–18 Years
Calories†	900 kcal	1000 kcal			
Female			1200 kcal	1600 kcal	1800 kcal
Male			1400 kcal	1800 kcal	2200 kcal
Fat	30-40% kcal	30-35% kcal	25-35% kcal	25-35% kcal	25-35% kcal
Milk/Dairy‡	2 cups¶	2 cups	2 cups	3 cups	3 cups
Lean Meat/Beans	1.5 oz	2 oz		5 oz	
Female			3 oz		5 oz
Male			4 oz		6 oz
Fruits§	1 cup	1 cup	1.5 cups	1.5 cups	
Female					1.5 cups
Male					2 cups
Vegetables§	3/4 cup	1 cup			
Female			1 cup	2 cups	2.5 cups
Male			1.5 cup	2.5 cups	3 cups
Grains_	2 oz	3 oz			
Female			4 oz	5 oz	6 oz
Male			5 oz	6 oz	7 oz

*Calorie estimates are based on a sedentary lifestyle. Increased physical activity will require additional calories: by 0-200 kcal/d if moderately physically active; and by 200–400 kcal/d if very physically active.

†For youth 2 years and older; adopted from Table 2, Table 3, and Appendix A-2 of the *Dietary Guidelines for Americans* (2005)14; <http://www.healthierus.gov/dietaryguidelines>. Nutrient and energy contributions from each group are calculated according to the nutrient-dense forms of food in each group (eg, lean meats and fat-free milk).

‡Milk listed is fat-free (except for children under the age of 2 years). If 1%, 2%, or whole-fat milk is substituted, this will utilize, for each cup, 19, 39, or 63 kcal of discretionary calories and add 2.6, 5.1, or 9.0 g of total fat, of which 1.3, 2.6, or 4.6 g are saturated fat.

§Serving sizes are 1/4 cup for 1 year of age, 1/3 cup for 2 to 3 years of age, and 1/2 cup for ≥4 years of age.

A variety of vegetables should be selected from each subgroup over the week.

¶Half of all grains should be whole grains.

¶¶For 1-year-old children, calculations are based on 2% fat milk. If 2 cups of whole milk are substituted, 48 kcal of discretionary calories will be utilized. The American Academy of Pediatrics recommends that low-fat/reduced fat milk not be started before 2 years of age.

Fiber and Children's Diets

AHA Recommendation

Children older than 2 years should gradually adopt American Heart Association dietary recommendations. That means saturated fat intake should be less than 7 percent of total calories, trans fat intake should be less than 1 percent of total calories, and dietary cholesterol should be limited to no more than 300 mg daily. Children should also get the majority of calories from complex carbohydrates high in fiber.

Both children and adults should consume 14g of fiber per 1,000 calories consumed*. Read the nutrition facts panel on the food label to determine how much fiber is in the food you are choosing. The table below provides an estimation of the amount of fiber children should eat each day.

Gender/Age	Fiber (grams)
1–3 years	19
4–8 years	25
9–13 years	
Female:	26
Male:	31
14–18 years	
Female:	29
Male:	38

High Blood Pressure in Children

AHA Recommendation

Children, even very young babies, can have high blood pressure. The American Heart Association recommends that all children age 3 and older have yearly blood pressure measurements. Early detection of high blood pressure will improve health care of children. High blood pressure is a major risk factor for heart disease and stroke in adulthood.

High blood pressure in children can be caused by other diseases — usually heart or kidney disease. This is called secondary hypertension. If the other disease is successfully treated, blood pressure usually returns to normal. Some medicines can cause high blood pressure, but when they're discontinued, blood pressure usually returns to normal.

A small number of children have higher blood pressures than others, but researchers don't know why. These children are said to have primary or essential hypertension.

Children who are overweight usually have higher blood pressure than those who aren't overweight.

Some children inherit the tendency from one or both parents who have high blood pressure. High blood pressure is more frequent and more severe in families of African Americans than among Caucasians. Researchers don't fully understand the reasons.

A prescribed special diet and regular physical activity may lower high blood pressure in overweight children. The doctor may also prescribe medication.

What are the classifications of high blood pressure in children?

In childhood, blood pressure normally rises with age.

A child's sex, age and height are used to determine age-, sex- and height-specific systolic and diastolic blood pressure percentiles. This approach provides information that lets researchers consider different levels of growth in evaluating blood pressure. It also demonstrates the blood pressure standards that are based on sex, age and height and allows a more precise classification of blood pressure according to body size. More importantly, the approach avoids misclassifying children at the extremes of normal growth.

Overweight in Children

AHA Recommendation

Overweight children are more likely to be overweight adults. Successfully preventing or treating overweight in childhood may reduce the risk of adult overweight. This may help reduce the risk of heart disease and other diseases.

When defining overweight in children and adolescents, it's important to consider both weight and body composition.

Among American children ages 6–11, the following are overweight, using the 95th percentile or higher of body mass index (BMI) values on the CDC 2000 growth chart:

- For non-Hispanic whites, 16.9 percent of boys and 15.6 percent of girls.
- For non-Hispanic blacks, 17.2 percent of boys and 24.8 percent of girls.
- For Mexican Americans, 25.6 percent of boys and 16.6 percent of girls.

Among adolescents ages 12–19, the following are overweight, using the 95th percentile or higher of BMI values on the CDC 2000 growth chart:

- For non-Hispanic whites, 17.9 percent of boys and 14.6 percent of girls.
- For non-Hispanic blacks, 17.7 percent of boys and 23.8 percent of girls.
- For Mexican Americans, 20.0 percent of boys and 17.1 percent of girls.

The prevalence of overweight in children ages 6–11 increased from 4.0 percent in 1971–74 to 17.5 percent in 1999–2004. The prevalence of overweight in adolescents ages 12–19 increased from 6.1 percent to 17.0 percent. (NHANES, NCHS)

How do you prevent and treat overweight in children?

Reaching and maintaining an appropriate body weight is important. That's why recommendations that focus on small but permanent changes in eating may work better than a series of short-term changes that can't be sustained.

- Reducing caloric intake is the easiest change. Highly restrictive diets that forbid favorite foods are likely to fail. They should be limited to rare patients with severe complications who must lose weight quickly.
- Becoming more active is widely recommended. Increased physical activity is common in all studies of successful weight reduction. Create an environment that fosters physical activity.
- Parents' involvement in modifying overweight children's behavior is important. Parents who model healthy eating and physical activity can positively influence their children's health.

In treating most overweight children, the main emphasis should be to prevent weight gain above what's appropriate for expected increases in height. This is called prevention of increased weight gain velocity. For many children this may mean limited or no weight gain while they grow taller. Recommendations for maintaining weight should include regular physical activity and careful attention to diet to avoid too many calories. Factors predicting success are:

- including parents in the dietary treatment program
- strong social support of dietary intervention from others involved in preparing food
- regular physical activity prescription including social support

The importance of continuing these lifestyle changes well past the initial treatment period should be emphasized to the entire family. The healthiest way to change weight is gradually.

How is body fat measured?

The **body mass index** (BMI) formula assesses weight relative to height. It provides a useful screening tool to indirectly measure the amount of body fat. Weight in kilograms is divided by height in meters squared (kg/m^2), or, multiply weight in pounds by 703, divide by height in inches, then divide again by height in inches. In children, the Centers for Disease Control and Prevention defines BMI-for-age at or above the 95th percentile as being overweight. It is important to assess the trend of the child's BMI as this is an indirect measure of body fat.

The CDC recommendations for screening and assessing for obesity and overweight in children and adolescents mention the use of the triceps skinfold test for further evaluation when the BMI-for-age is assessed above the 95th percentile. Importantly, while triceps skinfold thickness can be unreliable, evidence suggests that children and adolescents assessed to have a skinfold measure greater than the 95th percentile are more likely to have excess body fat as opposed to increased lean body mass or large frame size.

How to Make Fast Food Friendlier

Feeding your children nutritious meals between all your daily activities can be a challenge. While you zoom back and forth between soccer practice, the dance recital, the PTA meeting and picking up the dry cleaning, you're lucky to find time to grab a meal at the drive-thru. If you must eat on the go, here are some tips to make fast food healthier for you and your family members:

- Pass on the "value-size." When you supersize, the size of your fries isn't the only thing that gets bigger.
- Skip the sides. Eating a burger or sandwich by itself is often filling enough. If you do want a side, consider ordering a fruit cup or side salad. Most fast food restaurants now offer them.
- Avoid double meat and bacon. A serving size of meat is 2-3 ounces — about the size of a deck of cards. You're probably getting well over that with a single meat patty. Bacon is high in calories and fat with little nutrient content.
- Try the grilled chicken sandwich. Poultry without skin is significantly leaner than the meats most fast-food companies use in their burgers.
- Eat your sandwich open-faced. By eating only half the bun, you can eliminate unnecessary calories.
- Try asking for a wheat bun. Some places offer a wheat alternative, some don't. It never hurts to ask.
- Skip the mayo and other calorie-laden dressings and sauces.
- Drink water, diet soda or low-fat milk. Sodas are loaded with sugars, which have calories you don't need.

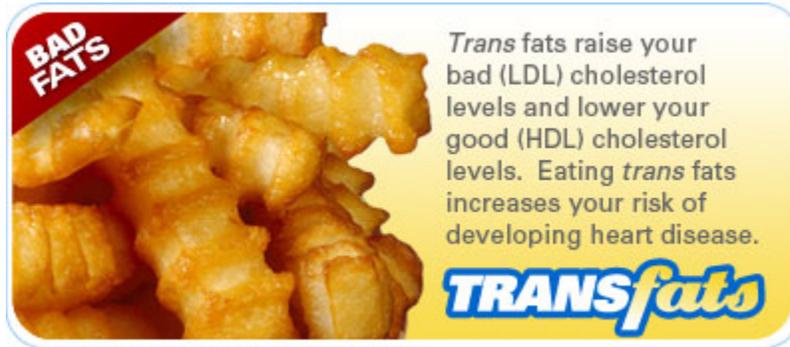
Take Control of Portion Sizes

Size matters. Portion size has a lot to do with why our kids are getting chubbier. Because there's too much of everything on their plates, our kids are getting far more calories than they need daily. To start "Operation Portion Control," you need to know how big a portion size really is. You may be surprised to learn these are serving sizes:

- 1 slice of bread
- ½ cup rice or pasta (cooked)
- 1 small piece of fruit (super-large apples are 2+ servings)
- 1 wedge of melon
- ¾ cup fruit juice
- 1 cup milk or yogurt
- 2 oz. cheese (about the size of a domino)
- 2-3 oz. meat, poultry or fish (this is about the size of a deck of cards)

Most servings are well over the standard portion size, so we're all getting extra calories we don't need. But with a little effort, we can take control. Cutting down the helpings will cut down the waistlines.

Trans Fats



What are *trans* fats?



Trans fats (or *trans* fatty acids) are created in an industrial process that adds hydrogen to liquid vegetable oils to make them more solid. Another name for *trans* fats is “partially hydrogenated oils.” Look for them on the ingredient list on food packages.



Why do some companies use *trans* fats?



Companies like using *trans* fats in their foods because they’re easy to use, inexpensive to produce and last a long time. *Trans* fats give foods a desirable taste and texture. Many restaurants and fast-food outlets use *trans* fats to deep-fry foods because oils with *trans* fats can be used many times in commercial fryers.



How do *trans* fats affect my health?



Trans fats raise your bad (LDL) cholesterol levels and lower your good (HDL) cholesterol levels. Eating *trans* fats increases your risk of developing heart disease and stroke. It’s also associated with a higher risk of developing type 2 diabetes.

Why did *trans* fats become so popular if they have such bad health effects?

A Before 1990, very little was known about how *trans* fat can harm your health. In the 1990s, research began identifying the adverse health effects of *trans* fats.



Q **What foods contain *trans* fats?**

A *Trans* fats can be found in many foods – but especially in fried foods like French fries and doughnuts, and baked goods including pastries, pie crusts, biscuits, pizza dough, cookies, crackers, and stick margarines and shortenings. You can determine the amount of *trans* fats in a particular packaged food by looking at the [Nutrition Facts](#) label. You can also spot *trans* fats by reading ingredient lists and looking for the ingredients referred to as “partially hydrogenated oils.”



Q **Are there any naturally occurring *trans* fats?**

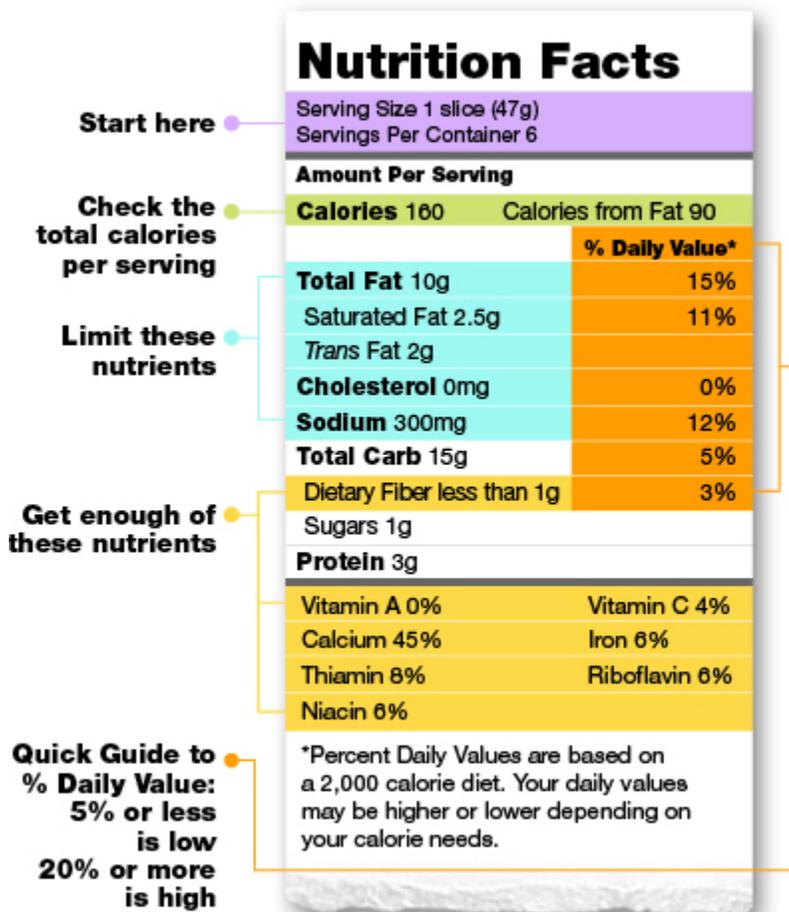
A Small amounts of *trans* fats occur naturally in some meat and dairy products, including beef, lamb and butterfat. It isn't clear, though, whether these naturally occurring *trans* fats have the same bad effects on cholesterol levels as *trans* fats that have been industrially manufactured.

Q **How much *trans* fat can I eat a day?**

A The American Heart Association recommends limiting the amount of *trans* fats you eat to less than 1 percent of your total daily calories. That means if you need 2,000 calories a day, no more than 20 of those calories should come from *trans* fats. That's less than 2 grams of *trans* fats a day. Given the amount of naturally occurring *trans* fats you probably eat every day, this leaves virtually no room at all for industrially manufactured *trans* fats.

Q **How can I stay within my daily limit for *trans* fats?**

A Read the Nutrition Facts label on foods you buy at the store and, when eating out, ask what kind of oil foods are cooked in. Replace the *trans* fats in your diet with monounsaturated or polyunsaturated fats. For practical tips, learn how to Live Fat-Sensibly.



Start here. Note the size of a single serving and how many servings are in the package.

Check total calories per serving. Look at the serving size and how many servings you're really consuming. If you double the servings you eat, you double the calories and nutrients, including the Percent Daily Value (% DV).

Limit these nutrients. Remember, you need to limit your total fat to no more than 56–78 grams a day — including no more than 16 grams of saturated fat, less than two grams of *trans* fat, and less than 300 mg cholesterol (for a 2,000 calorie diet).

Get enough of these nutrients. Make sure you get 100 percent of the fiber, vitamins and other nutrients you need every day.

Quick guide to % DV. The % DV section tells you the percent of each nutrient in a single serving, in terms of the daily recommended amount. As a guide, if you want to consume less of a nutrient (such as saturated fat, cholesterol or sodium), choose foods with a lower % DV — 5 percent or less is low. If you want to consume more of a nutrient (such as fiber), seek foods with a higher % DV — 20 percent or more is high.

Here are more tips for getting as much health information as possible from the Nutrition Facts label:

- Remember that the information shown in these panels is based on 2,000 calories a day. You may need to consume less or more than 2,000 calories depending upon your age, gender, activity level, and whether you're trying to lose, gain or maintain your weight.
- In general, as you think about the amount of calories in a food per serving, remember that for a 2,000-calorie diet:
 - 40 calories per serving is considered low;
 - 100 calories per serving is considered moderate; and
 - 400 calories or more per serving is considered high.
- There is no % DV shown for *trans* fat on the panel because the U.S. Food and Drug Administration (FDA) does not have enough scientific information to set this value. We recommend eating less than 20 calories or (less than two grams of *trans* fat) a day – that's less than 1 percent of your total daily calories (for a 2,000-calorie-a-day diet).
- When the Nutrition Facts panel says the food contains "0 g" of *trans* fat, it means the food contains less than 0.5 grams of *trans* fat **per serving**.
- When the Nutrition Facts label says a food contains "0 g" of *trans* fat, but includes "partially hydrogenated oil" in the ingredient list, it means the food contains *trans* fat, but less than 0.5 grams of *trans* fat per serving. So, if you eat more than one serving, you could quickly reach your daily limit of *trans* fat.

