

# Aging

## Activity Summary

Students analyze the fat content in several food items and identify food items that contain one day's worth of heart-healthy fat calories.

## Materials for Each Group

- copy of "Total Fat: What Does it all Mean?" student handout
- copy of the "Nutritional Label Analysis" student handout
- 3 different packages (empty or full) of food that contains fat and cholesterol. Packages should include Nutrition Fact labels that disclose amounts of heart-healthy fats and saturated fats)
- pens or pencils

## Background

The aging process is not completely understood. There is a set range of years that a species in a particular environment is expected to live—its life span—and some biological processes related to life span are genetically programmed. Organisms within a species live for fewer years or for more years than their expected life span range because of genetic factors and/or environmental effects (such as pollution, drugs, alcohol, physical activity, and diet). One health condition that prevents many people from reaching the expected life span range is cardiovascular, or heart, disease.

Cardiovascular disease has been the number one killer in the United States for about 100 years for both men and women. Most scientists view it as a complex disease with many different causes. Researchers studying long-lived people (longevity) are interested in better understanding genes that may play a role in decreasing one's risk for cardiovascular disease. Some scientists are asking the question, "Do people who live in good health several years beyond their expected life span range have genes (and behaviors) that protect them from heart disease?" Researchers are finding that genetic variants exist in centenarians. Eighty percent of the centenarians in the study featured in the program segment had higher levels of HDL (high-density lipoprotein) and larger molecules of HDL in the bloodstream than the general population.

Cholesterol is a fat-soluble substance that has many important functions in the body. It plays a role in cell membrane structure, in brain tissue, in the synthesis of vitamin D, and in some hormones. Cholesterol in our bloodstream is called *blood cholesterol*. Dietary cholesterol comes from animals and is found in foods such as meat and butter. It is complex, because *dietary cholesterol* is not the major determinant of blood cholesterol. Genetics and *dietary fat*, particularly saturated fat, are the major determinants of blood cholesterol levels. High levels of a certain form of blood cholesterol, LDL (low-density lipoprotein), is the major

## LEARNING OBJECTIVES

Students will be able to:

- understand that genetics plays a role in determining blood cholesterol level, but the environment and lifestyle (dietary factors) also play a role.
- understand how a compromised circulatory system can prevent a person from reaching the expected life span range, and that both genetics and the environment (exercise, smoking, diet) play a role in a healthy circulatory system.
- identify four different types of dietary fat (saturated fat, monounsaturated fat, polyunsaturated fat, and trans fat) and the possible effect each type has on blood cholesterol (HDL and LDL) levels.
- analyze the fat content in food items and consider the possible relationships to heart health and longevity.
- determine food items that represent recommended requirements for one day's serving of dietary fat.

## EXPLORE MORE ONLINE

### Genes, Fat, and the Heart

Visit the Howard Hughes Medical Institute interactive at [www.hhmi.org/biointeractive/cardiovascular/index.html](http://www.hhmi.org/biointeractive/cardiovascular/index.html) to learn how blood flows through the heart and how arteries blocked with plaque contribute to heart attacks.

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## CLASSROOM ACTIVITY (CONT.)

contributor to plaque formation on the walls of our blood vessels. Plaque buildup in coronary arteries can lead to partially or totally blocked arteries and a heart attack, as well as to other types of heart disease.

Our liver makes most of the cholesterol in our body, but some comes from the food we eat. The liver links cholesterol to lipoproteins—small spherical particles that circulate in the blood and contain fat and protein in different amounts. Two of these lipoproteins, HDL (known as the “good” cholesterol) and LDL (known as the “bad” cholesterol), affect artery plaque formation and heart health. One function of LDL is to move cholesterol from the liver to places in the body where it can be used. A function of HDL is to deliver cholesterol from body tissues back to the liver, getting rid of some cholesterol from the blood. Scientific studies show that people with high HDL relative to other lipoproteins are less likely to die from heart disease. People with high levels of LDL cholesterol are at increased risk for developing artery cholesterol plaque and heart disease.

The levels of HDL and LDL in one’s bloodstream are strongly determined by genetics, especially in younger people. However, dietary fat intake (especially saturated fat) seems to affect blood cholesterol (HDL and LDL) levels more than the amount of dietary cholesterol ingested. Some scientific studies have shown that people can lower their risk for cholesterol-related heart disease by exercising regularly, keeping a healthy body weight, and paying attention to the kind of fat they consume. United States Dietary Guidelines health recommendations regarding fat include limiting saturated fats, minimizing trans fats, and replacing both saturated and trans fat with poly- and monounsaturated fat. Reducing dietary fat doesn’t necessarily reduce one’s risk of disease. Other risk factors, such as smoking, drug use, exercise, and genetics also play a role. Fat in the diet is essential—particularly for children and teens. It is the type of fat one eats that seems to matter most in relation to heart disease.

Saturated fat raises HDL and LDL. It is found in butter, whole milk, red meat, and cheese. This type of fat should be limited in the diet. Polyunsaturated and monounsaturated fats both lower HDL, but they lower LDL more, and that is why they are recommended. Monounsaturated fats are found in canola and olive oil and in smaller amounts in olives, cashews, almonds, peanuts, walnuts, and avocados. Polyunsaturated fats are found in sunflower, safflower, corn, and soybean oils, as well as in many nuts. A particularly heart-healthy polyunsaturated fat, called omega-3 fatty acids, is found in fish. It’s best to obtain one’s daily fat calories from monounsaturated and polyunsaturated fats. Trans fats are found in some types of margarine, vegetable shortening, commercial baked goods, and in most types of French fries and fast foods. Trans fat lowers HDL and raises LDL; it is best to eliminate trans fat from one’s diet.

## KEY TERMS

**arteriosclerosis:** A disease of the circulatory system. One aspect of the disease includes the accumulation of cholesterol plaque on artery walls. This decreases the space through which blood can flow to nourish the heart muscle.

**cholesterol:** A steroid made in the liver. A fat-soluble substance with many important functions in the body. It plays a role in cell membrane structure, brain tissue, in the synthesis of vitamin D, and in some hormones.

**HDL:** High-density lipoprotein, or “good” cholesterol. HDL delivers cholesterol from body tissues back to the liver for recycling or excretion from the body.

**LDL:** Low-density lipoprotein, or “bad” cholesterol. LDL transports cholesterol from the liver to places in the body where it can be used or accumulate. It may affect artery cholesterol plaque formation and heart health.

**life expectancy:** The number of years, based on statistics, that a person is expected to live.

**life span:** The average length of time, often expressed in a range, a species in a particular environment can be expected to survive. Lifestyle choices can influence whether humans reach their expected life span range. Physical activity, smoking, drug use, and other lifestyle choices can alter the risk of developing heart and other diseases.

**longevity:** Living beyond one’s expected life span.

**monounsaturated fat:** This type of fat is usually a liquid at room temperature. It lowers blood HDL and LDL levels, but lowers LDL more, so it is beneficial. Found in canola, peanut, and olive oil.

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## CLASSROOM ACTIVITY (CONT.)

Because such a tremendous amount of growth and development occurs during infancy, childhood, and the teenage years, a healthy diet is extremely important during this time. Recommended caloric intake varies depending on body size and level of physical activity, but in general, adolescent girls need about 2200 calories per day and boys about 2400 calories per day. Competitive athletes can require about 800 calories more. Fat intake should equal about 25–35 percent of the total calories, and about 10 percent or less of the total daily calories should come from saturated fats.

In this activity, students will learn about dietary fats, their influence on blood cholesterol, and the role of HDL and LDL in some types of heart disease. Groups learn about different kinds of fat in foods that affect levels of good (HDL) and bad (LDL) cholesterol in the bloodstream. They analyze the fat content in food items that contain fat, and they identify food items that represent one day's worth of recommended heart-healthy fat calories.

### Procedure

- 1 Have students review some commonalities among the centenarians and people in their 90s that may have contributed to their longevity. *(Some commonalities include their genes, high HDL and larger molecules of HDL, and a positive outlook on life.)* Accept all reasonable answers.
- 2 Consider with students what it means when we say that some people have a genetic constitution that allows them to live a healthy life much longer (20 years or more) than other people. Centenarians may have genes different from the general population's that play a role in health and longevity. Which diseases might these "longevity genes" be instrumental in preventing? *(Diseases can include heart disease, and some illnesses like cancer.)* Accept all reasonable answers.
- 3 Explain to students that cardiovascular, or heart, disease is the number one killer in the United States today. Some scientists researching long-lived people (longevity) are interested in better understanding genetic, environmental, and lifestyle factors that may play a role in decreasing one's risk for heart disease. Have students share some factors they have read or heard about that seem to contribute to some types of heart disease. *(Factors include smoking, lack of exercise, stress, and dietary factors, particularly related to some types of dietary fat. Students who have family members with heart disease may know of other factors. Inflammation and being overweight also play a role.)* Tell students this lesson focuses on dietary fats and cholesterol.
- 4 Review vocabulary terms (see Key Terms, pages 2 and 3) including the roles of HDL and LDL in the body, and the role of each of these lipoproteins in relation to heart disease.

## KEY TERMS (CONT.)

**polyunsaturated fat:** This type of fat is usually a liquid at room temperature. It lowers blood HDL and LDL levels, but lowers LDL more, so it is beneficial. Found in sunflower, corn, and soybean oil.

**saturated fat:** This type of fat is usually solid at room temperature. High intake seems to raise cholesterol—both HDL and LDL. Mainly found in meat and dairy products.

**trans fat:** This type of fat is made when vegetable oils are hydrogenated. The process hardens the oils and makes the products stay fresh longer. High intake seems to lower HDL and raise LDL. Found in many commercial baked goods and fast foods.

## CLASSROOM ACTIVITY (CONT.)

- 5 Draw the Nutritional Recommendations Chart (see Activity Answer on page 5) on the board, leaving out the calorie information in the columns next to total fat. Ask students to calculate the calorie amounts.
- 6 Draw the Dietary Fat Chart (see Activity Answer on page 5) on the board and only include the headings and the information under the Type of Fat, Potential Effect on HDL, and Potential Effect on LDL columns. Divide the class into four groups. Assign each group one of the types of dietary fat to research. (See Links & Books on pages 5 and 6 for resources.) Have students complete the other columns in the chart using their research findings.
- 7 As a class, review the charts. Give each group a student handout (Nutritional Label Analysis) and three empty food packages or food containers with Nutrition Facts labels. Take precaution for any students who may have food allergies.
- 8 Review the student handout. Ask each group of students to choose one item and find its Nutrition Facts label. Ask how people generally use nutrition labels regarding fat content (*to find out the calories from fat, to choose foods low in saturated and trans fats, to choose foods containing mono- and polyunsaturated fat.*) Accept all reasonable answers. Then have groups answer Nutrition Facts label questions on their handout. (Explain that adding up the fat in all foods eaten in one day should equal about 100 percent daily value for fat. Daily dietary fat should equal about 25–35 percent of total daily calories, and it should consist mainly of mono- and polyunsaturated fat. Saturated fat should equal no more than 10 percent of total daily calories.)
- 9 Have groups share their most surprising finding, good or bad.
- 10 Next, using information covered and resources in the “Analyzing Food Items” section of their “Total Fat” handout, have the groups identify four different fat-containing food items (at least three with a heart-healthy dominant fat type) and determine a serving size for each so that the total amount of food selected contains about one day’s worth of recommended dietary fat for a teen. Ask students to first review the charts on the board and read the “Analyzing Food Items” tips on their handouts. When they’re finished, have them write the information in the *Food Items Representing Healthy Dietary Fat for One Day* chart on their student handout.

Extension: Have groups research different types of coronary disease, such as arteriosclerosis, heart attack, stroke, hypertrophic cardiomyopathy, and others. Students can write about whether and how genetic, environmental, and lifestyle factors affect each condition. Have groups display their work in posters and present them to the class.

## STANDARDS CONNECTION

The “Total Fat: What Does It All Mean?” activity aligns with the following National Science Education Standards (see [books.nap.edu/html/nses](https://books.nap.edu/html/nses)).

GRADES 5–8

### Life Science

- Structure and function in living systems
- Reproduction and heredity

### Science in Personal and Social Perspectives

- Personal health

GRADES 9–12

### Life Science

- The cell
- The molecular basis of heredity

### Science in Personal and Social Perspectives

- Personal and community health

Video is not required  
for this activity.

### Classroom Activity Author

Developed by WGBH Educational Outreach staff.

## ACTIVITY ANSWER

### Nutritional Recommendations Chart

	Girls aged 14–18	Boys aged 14–18
<b>cholesterol (mg)</b>	< 300	< 300
<b>total fat (g)</b>	55–85 (25–35 percent of daily calories, or about 500–770 calories)	61–95 (25–35 percent of daily calories, or about 550–840 calories)
<b>saturated fat (g)</b>	no more than 24 < 10 percent of daily calories	no more than 27 < 10 percent of daily calories
<b>calories</b>	2000–2200	2200–2400

### Dietary Fat Chart

Type of fat	Description	Foods Containing the Fat	Potential Effect on HDL	Potential Effect on LDL	Heart-Healthy or Not
Saturated	from animal-based food items and some plants	butter, meat, whole milk, coconut oil	raises	raises	okay if limited to 10 percent or less of total daily calories; seems to raise blood cholesterol when above recommended dietary amounts
Monounsaturated	found mainly in oils from plants	peanuts, cashews, almonds, avocados	lowers	lowers more than it lowers HDL	considered heart-healthy in recommended amounts because it lowers LDL more than HDL
Polyunsaturated	found mainly in oils from plants	olive oil, canola oil, salmon, pumpkin seeds	lowers	lowers more than it lowers HDL	considered heart-healthy in recommended amounts because it lowers LDL more than HDL
Trans	made when vegetable oils are hydrogenated	mostly in doughnuts, fast food	lowers	raises	should be eliminated from diet

## LINKS AND BOOKS

### LINKS

#### NOVA scienceNOW

[www.pbs.org/nova/sciencenow/3401/01.html](http://www.pbs.org/nova/sciencenow/3401/01.html)

Offers aging-related resources, including streamed video, information about sirtuins, and expert information.

#### Dietary Guidelines for Americans 2005

[www.health.gov/DIETARYGUIDELINES/dg2005/document/html/chapter6.htm](http://www.health.gov/DIETARYGUIDELINES/dg2005/document/html/chapter6.htm)

Contains key dietary recommendations regarding dietary fats.

#### Fats and Cholesterol

[www.hsph.harvard.edu/nutritionsource/fats.html](http://www.hsph.harvard.edu/nutritionsource/fats.html)

Provides information on cholesterol and the effect different kinds of dietary fats have on blood cholesterol.

#### How Do the Daily Values Found on Food Labels Compare to the Nutritional Recommendations for Children?

[www.bcm.edu/cnrc/consumer/archives/percentDV.htm](http://www.bcm.edu/cnrc/consumer/archives/percentDV.htm)

Presents a nutrient recommendation table that helps you better understand nutrition facts on food labels.

#### MyPyramid.gov Dietary Guidelines

[www.mypyramid.gov](http://www.mypyramid.gov)

Includes dietary information, including a search feature that allows you to find calorie values of food items.

#### National Lipid Association

[www.lipid.org/clinical/patients/1000001.php](http://www.lipid.org/clinical/patients/1000001.php)

Includes information about recommended levels for total cholesterol, LDL, and triglycerides.

## ACTIVITY ANSWER (CONT.)

The answers to the questions on the student handout will vary, depending on the items the students analyze. Remind students that fat in the diet (25–35 percent of daily calories) is essential for healthy growth and development, and that while healthful variety is good, food often contains other ingredients (such as salt or sugar) that are not healthful in high amounts.

Students' charts on healthy dietary fat will vary, depending on the food items they identify. A sample answer might be the following:

Food Items Representing Healthy Dietary Fat for One Day	
<p>A.</p> <p>Food item: walnuts</p> <p>Food amount: 3/8 cup</p> <p>Calories from fat: 242</p> <p>Grams saturated fat: 3</p>	<p>B.</p> <p>Food item: olive oil</p> <p>Food amount: 1 tbsp</p> <p>Calories from fat: 120</p> <p>Grams saturated fat: 2</p>
<p>C.</p> <p>Food item: peanut butter</p> <p>Food amount: 3 tbsp</p> <p>Calories from fat: 225</p> <p>Grams saturated fat: 4.5</p>	<p>D.</p> <p>Food item: ice cream</p> <p>Food amount: 1/2 cup</p> <p>Calories from fat: 70</p> <p>Grams saturated fat: 5</p>
<p>Total calories from fat = 657 (Should be in 500-840 range, depending on gender of teen)</p> <p>Total grams of saturated fat = 14.5 (Under 24-27 g)</p>	

## LINKS AND BOOKS (CONT.)

### The Importance of Dietary Fat and Cholesterol: A Guide for Teens

[www.youngwomenshealth.org/cholesterol.html](http://www.youngwomenshealth.org/cholesterol.html)

*Includes a section on cholesterol, different kinds of dietary fats, and a link that explains Nutrition Facts food labels.*

### The Genes We Share

[hhmi.org/geneshare/g200.html](http://hhmi.org/geneshare/g200.html)

*Provides information about the use of yeast, mice, worms, and flies in laboratory research.*

### BOOKS

#### Human Anatomy

by Kristie Hills, Philippa Colvin (Editors). Dorling Kindersley, 2004. *Presents a detailed diagram of the heart and blood vessels.*

#### Human Body

by Steve Parker. Dorling Kindersley, 2004. *Includes a detailed section on the heart and circulatory system.*

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# Total Fat: What Does It All Mean?

Did you know that the mix of different types of fats—monounsaturated, polyunsaturated, saturated, and trans—in our diet may affect heart health? In this activity, you will review different types of fat and how each type may affect blood HDL and LDL levels. You will examine the fat content in food items by analyzing Nutrition Facts labels. Finally, you'll identify food items that contain one day's worth of recommended heart-healthy fat for a teen for one day.

## Procedure

- 1 Find the Nutrition Facts label on one food item wrapper, then answer the questions on your "Nutritional Label Analysis" handout. When you are finished, answer the same questions for the remaining two food items.
- 2 Next, choose four different fat-containing food items and determine a serving size for each so that the total amount of food you select contains one day's worth of recommended dietary fat for a teen. (To help you do this, review the charts on the board and read "Analyzing Food Items" on this handout.) When you are finished, write your food items and amounts in the chart that follows.

## Analyzing Food Items

- Use [www.mypyramid.gov](http://www.mypyramid.gov) to help you find food items and calorie values.
- The Fats in Food box on this sheet includes a list of some types and sources of fat.
- Total fat calories for one day for girls average about 650 calories (more for athletes). Ten percent or less of total daily calories may come from saturated fats.
- Total fat calories for one day for boys average about 700 calories (more for athletes). Ten percent or less of total daily calories may come from saturated fats.
- Grams of saturated fat should be no more than 24 for girls and no more than 27 for boys.
- Note that you are only looking at dietary fat. Balanced diets include carbohydrates, proteins, and healthy fat.

### Fats in Food

Some fat-containing foods:

#### Polyunsaturated Fat

soybean, corn, safflower, sunflower oils and foods made of these; pumpkin seeds; and for omega-3: halibut, salmon, tuna, green leafy vegetables, soy, walnuts

#### Monounsaturated Fat

canola and olive oil, peanut butter, avocados, almonds, cashews

#### Saturated Fat

butter, milk, meat, cheese, ice cream (depending upon the type)

### Food Items Representing Healthy Dietary Fat for One Day

A. Food item: Food amount: Calories from fat: Grams saturated fat:	B. Food item: Food amount: Calories from fat: Grams saturated fat:
C. Food item: Food amount: Calories from fat: Grams saturated fat:	D. Food item: Food amount: Calories from fat: Grams saturated fat:
Total calories from fat =	
Total grams of saturated fat =	

# Nutritional Label Analysis

	Food Item 1	Food Item 2	Food Item 3
How many calories per serving from fat?			
What quantity (of the food) makes up one serving?			
What is the percent daily value from fat?			
How much saturated fat does the item contain?			
How much mono-unsaturated (heart-healthy) fat does the item contain?			
How much polyunsaturated (heart-healthy) fat does the item contain?			
How much trans fat does the item contain?			
What is the typical amount of this food item a teen might eat in one day?			
Does the food item have high sodium, which may also play a role in heart disease?			