Lipids: Fat and Oil

At a Glance

Recommended Dietary Intake:
30 g for adults = 270 calories
% of Daily Calories: 15-25%

Calories per Gram of food: 9
For example, a 1 oz serving of peanuts has 14 grams of fat which equals 126 calories

Types of Lipids (commonly referred to as "fat"):

- Saturated
- Unsaturated
  - Monounsaturated
  - Polyunsaturated
- Essential Fatty Acids (Omega-3 and Omega-6)
- Trans-Fatty Acids

Function: Dietary and stored fat provides about half of the body's energy needs during rest and light activity. Fat is the main energy storage molecule. Layers of fat protect vital organs. Vitamins A, D, E, and K are fat-soluble and need fat to be absorbed into the body.

Food Sources: Meat, seafood, dairy, nuts, seeds, oils, olives, avocados, processed food.

Typical Serving size: ½ of a filet of salmon contains 13 g of fat

Health Concerns: Too much fat intake can contribute to obesity, adult onset diabetes, heart disease, stroke and some cancers.

Fat in the Body and Food

Contrary to popular belief, dietary fat is vital to human life. Fat is the most abundant and efficient form of energy storage in the body and is used for muscles at rest and light activity. In addition, fat surrounds and protects vital organs, and insulates us from cold. Most cell membranes have a fat layer. Highest quantities are found in animal products and highly processed foods. This does not mean that all fat is created equal, however. Healthy fats are unsaturated, and mostly come from plant sources, like nuts, seeds, and fatty fruits like avocados.

Other healthy fats come from fish and seafood, such as salmon, tuna, or shellfish, and plants such as flax seeds or walnuts. These foods contain an essentially fatty acid, known as omega-3, which is important in cognitive development and functioning. The omega-6 fatty acids are found in abundance in the typical American diet,



What fats should be eaten or avoided?

While fat is essential to human life, not all fat is created equal. "Bad" fats or fats that should be limited come in the form of saturated and trans-fats. Saturated fats can be found in abundance in certain animal products, such as red meat, poultry, seafood, and dairy products like cheese. Choosing leaner options of all of these foods is recommended.

Artificial trans-fats are a byproduct of the process of making a solid fat out of a liquid fat, such as hydrogenated vegetable oils. This improves the texture, shelf life, and flavor of the fat. These fats are used in many processed and restaurant foods. However researchers discovered that trans-fats have similar negative health impacts as saturated fats and are considered more dangerous. As a result, the FDA requires that trans-fats be listed on food labels. In addition, some cities have banned it from all restaurant food, and many food processors have eliminated trans-fats from their foods.

Read food labels and try reducing total fat consumption, especially trans- and saturated fats. With 9 calories per gram, reducing fat is a great way to decrease total calorie consumption and to reduce body weight.

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Selecting Healthy Food Using Food Labels

Goal: Learn how to use the Nutrition Facts Label to select foods that are low in fat.

Exercise: The Food and Drug Administration requires a nutrition facts panel on all packaged food products. This exercise demonstrates how to read and interpret the label in order to compare different foods. Have your students compare the two nutrition fact labels below to assess the fat information on the label. Notice that the fat content of 1 ounce of peanuts is similar to the snickers bar. Notice the serving size. Is it how much you would eat in one sitting? Then notice that the snickers bar has much more saturated fat, sugar, and sodium than the peanuts. Also, because they are low in saturated fat, the peanuts have "healthier" fats. Also, notice how many ingredients are in the snickers bar. This exercise shows students that you must look at the entire label before evaluating which foods are healthy or not.

Peanuts

Nutrition Facts
Serving Size 1 ounce 28g (1 ounce (28g))

Amount Per Serving
Calories 159 Calories from Fat 115

	% Daily Value*
Total Fat 14g	21%
Saturated Fat 2g	10%
Trans Fat	
Cholesterol 0mg	0%
Sodium 5mg	0%
Total Carbohydrate 5g	2%
Dietary Fiber 2g	10%
Sugars 1g	
Protein 7g	

Vitamin A 0% • Vitamin C 0%
Calcium 3% • Iron 7%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

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Ingredients: Peanuts

Snickers Bar

Nutrition Facts
Serving Size 1 bar 2 oz 57g (57 g)

Amount Per Serving
Calories 271 Calories from Fat 122

	% Daily Value*
Total Fat 14g	21%
Saturated Fat 5g	26%
Trans Fat 0g	
Cholesterol 7mg	2%
Sodium 140mg	6%
Total Carbohydrate 35g	12%
Dietary Fiber 1g	5%
Sugars 29g	
Protein 4g	

Vitamin A 2% • Vitamin C 0%
Calcium 5% • Iron 2%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

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Ingredients: Milk chocolate (sugar, cocoa butter, chocolate, skim milk, lactose, milk fat, soy lecithin, artificial flavor), peanuts, corn syrup, sugar, milk fat, skim milk, partially hydrogenated soybean oil, lactose, salt, egg whites,

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History and Lipids

- Identify key steps in a text's description of a process related to history/social studies. (CCSS.ELA-Literacy.RH.6-8.4)
- Describe how a text presents information (e.g., sequentially, comparatively, causally). (CCSS.ELA-Literacy.RH.6-8.5)
- Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies. (CCSS.ELA-Literacy.RH.6-8.4)

DID YOU KNOW?	LESSONS IDEAS	INFORMATION AND CURRICULUM
Growing food... Foodways is the historical study of the role of food, farming and culture in society. Fat has come from many animal and plant sources in different societies depending on resources, affluence, culture, etc.	Discuss various cultures around the world and compare and contrast the predominant fat in their diets (i.e. animal vs. plant, soy vs. palm, nuts vs. olives, etc.) Research the history of "soul food" and the the reason it tends to be high in fat. What is the history of vegetable oil production worldwide? Research the techniques used to extract oils from the seeds of the various crops used.	***Canola Oil, United States Department of Agriculture, Economic Research Service*** www.ers.usda.gov/topics/crops/soybeans-oil-crops/canola.aspx#.UVCCHls4Xqw ***The Cooking Gene, preserving and promoting African American foodways*** http://thecookinggene.com/ ***The Food Museum, Exploring and Celebrating Food*** http://foodmuseum.com/
Eating food... Americans eat about 30% of their daily calories from fat. The USDA recommends between 20 and 35%. While most Americans are in this range, the proportion of saturated fat is too high.	What were the primary sources of fat in the American diet 100 years ago and how do they compare to today? Describe what sources of fat other nations rely on (olives and nuts in the Mediterranean, animal and processed/added in the US, peanuts in Western Africa, seal blubber in Inuit cultures).	***Profiling Food Consumption in America, USDA*** www.usda.gov/factbook/chapter2.pdf ***Global and regional food consumption patterns/trends, WHO*** www.who.int/nutrition/topics/3_foodconsumption/en/index2.html ***Team Nutrition, USDA, Serving Up MyPlate: A Yummy Curriculum*** http://teamnutrition.usda.gov/Resources/sump_level3.pdf

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Science and Lipids

- Cite specific textual evidence to support analysis of science and technical texts.(CCSS.ELA-Literacy.RST.6-8.1)
- Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.(CCSS.ELA-Literacy.RST.6-8.5)
- Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. (CCSS.ELA-Literacy.RST.6-8.6)

DID YOU KNOW?	LESSONS IDEAS	INFORMATION AND CURRICULUM
Growing food... As in humans, plants produce fats as a way to store energy. Typically, fats in plants are centralized in the seeds. Due to the high energy content of fatty acids, more energy can be stored in a smaller volume. When the seed germinates, these fats can be converted to carbohydrate for energy to help the seed grow.	Discuss why fats and oils are important to both plants and animals, including humans. How do people use fat in a similar way to plants? What types of fats are found in animal foods and how do they differ from plant foods? Have students read Britannica entry on fats and discuss structure and point of view.	***Plant Oils and Fats*** www.cyberlipid.org/glycer/glyc0005.htm ***Britannica, Fats*** www.britannica.com/EBchecked/topic/202365/fat ***Kids Health, Lesson Plan, Fats*** http://kidshealth.org/kid/nutrition/food/fat.html
Eating food... While there are many different fatty acids in the typical human diet, only two are known to be "essential," meaning they cannot be produced by the body and must be consumed from food - omega-3 and omega-6 fatty acids. Each are polyunsaturated fats. Other types include monounsaturated, saturated, and trans-fatty acids. Unsaturated fats are liquid at room temperature, while saturated fats are solid at room temperature.	Compare the chemical difference between saturated and unsaturated fatty acids. Why are saturated fats solid at room temperature versus liquid unsaturated fats? Read the article on essential fatty acids from PCRM and analyze the author's point of view	***Basics of Fats, CDC*** www.cdc.gov/nutrition/everyone/basics/fat/index.html ***Essential Fatty Acids, PCRM*** www.pcrm.org/health/health-topics/essential-fatty-acids ***Affairs of the Heart Lesson Plan, PBS*** www.pbs.org/saf/1104/teaching/teaching3.htm

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Math and Lipids

- Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). (CCSSM.6.EE.4)
- Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. (CCSSM.7.RP.1)
- Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association. (CCSSM.8.SP.1)

DID YOU KNOW?	LESSONS IDEAS	INFORMATION AND CURRICULUM
Growing food… Global production of palm and soybean oil amounts to 41 million metric tons annually for each. The US produces about 1 million metric tons of corn oil, largely for use in processed goods.	A farmer will yield about 135 pounds of corn oil per acre grown. How many acres are needed to produce 1 million tons of corn oil in the US? Soybeans produce 345 pounds of oil per acre while palm produces a whopping 4,585 pounds per acre. What are the acreages needed to meet global demand for these oils?	***Ten Oil Producing Crops Yield Table,* Autonopedia** http://autonopedia.org/renewable-energy/biofuels/grow-your-own-fuel/ ***Team Nutrition, USDA, Nutrition Voyager, Trek 3 From Farm to You*** http://teamnutrition.usda.gov/Resources/nutvoyage8_trek3.pdf
Eating food… Due to the high caloric content of fat, at 9 kcal per gram, the most concentrated source of calories in any diet is added oils. Just one tablespoon of olive oil contributes 125 calories and 14 grams of fat.	Bring in wrappers from various processed foods and calculate ratio of calories from fat versus total calories in product. Plot percentages on graphs with labels to illuminate high fat food products. How many grams of fat are consumed in the USA? What percent of the American diet is due to fat? Graph with pie charts.	***A Century of Data on Food Availability (Consumption), Economic Research Service, USDA*** http://webarchives.cdlib.org/sw1s17tt5t/http://ers.usda.gov/Features/Centennial/ ***Global and regional food consumption patterns/trends, WHO*** ***w***ww.who.int/nutrition/topics/3_foodconsumption/en/index2.html
On average, Americans consume 600 calories daily from fats, which account for about 30% of the total daily caloric intake of the average American.	Adolescent youths (12–19 years) consumed an average of 40% of their daily calories from added sugar and fat. How many total calories do youths consume from each?	***Using Food to Teach Pie Graphs*** http://wikieducator.org/Sample_math_lesson ***Using Nutrition Labels to Teach Math, ehow*** www.ehow.com/info_7877480_math-activities-using-nutrition-labels.html

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Language Arts and Lipids

- Determine a theme or central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments. (CCSS.6.RL)
- Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (CCSS.6.W)
- Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation. (CCSS.6.SL)

DID YOU KNOW?	LESSONS IDEAS	INFORMATION AND CURRICULUM
Growing food... The American food system is a complex process of delivering food from seed to table in an affordable, safe way. Technology, war, consumerism and policy are some of the factors that have influenced the system.	Decide on a food system theme and write a paper or prepare a debate. Watch food films, podcasts or read blogs about farming and then discuss the differences between opinion and fact. Visit the National Agricultural Library or the Agricultural Research Service National Visitors Center in Beltsville MD	***Teaching the Food System, Johns Hopkins University*** www.jhsph.edu/research/centers-and-institutes/teaching-the-food-system/curriculum/ ***Growing a Nation, The Story of American Agriculture*** www.agclassroom.org/gan/inst_unit.htm www.agclassroom.org/gan/pdf/inst_unit.pdf ***Escape Fire, CNN*** www.cnn.com/SPECIALS/health/escape-fire-documentary
Eating food... Classic literature, like works of Charles Dickens, Jane Austen and Oscar Wilde, has frequent references to farming, food and cooking, and those experiences help us understand the characters, the settings and the historical context.	Notice the food references in the poems and novels being read and do research that helps students understand the broader context. Compare food guides from different countries to understand how a healthy diet is promoted. How do the fat recommendations differ? Have students fill out a blank MyPlate with their favorite sources of healthy fats from the list.	***MyPlate, Oils, USDA*** www.choosemyplate.gov/food-groups/oils.html ***Harvard Healthy Eating Plate, Harvard University*** www.hsph.harvard.edu/nutritionsource/healthy-eating-plate/ ***Japanese Food Guide Spinning Top*** www.mhlw.go.jp/bunya/kenkou/pdf/eiyou-syokuji5.pdf ***Research Food Guides from Around the World!***