

Chapter 10

Fats and Oils



Fats and high fat food products are highly scrutinized components of the American diet due to concerns with high rates of heart disease and obesity. Many food manufacturers attempt to make healthier products by reducing the fat in food formulations. In the grocery store, you can find many products labeled fat-free, low-fat, reduced-fat, or saturated fat-free. In other cases, manufacturers try adding healthier fats, such as **omega-3 fatty acids**, to market their food products. The choice of fat (butter, vegetable oil, olive oil, etc.) for food formulations not only depends on the nutritional aspects of the fat, but on its price and the desirable quality characteristics the fat brings to the food product. When fat is removed from a product, other ingredients, such as sugar and salt, are typically added to produce the desired flavor and mouth feel.

Fats can truly enhance food products by contributing to the flavor, texture, nutrient value, and **mouth feel** (the way food feels in one's mouth). Fats may enhance the appearance of a food product and promote satiety. Achieving a healthy, flavorful diet is a balancing act for consumers as they purchase and prepare foods containing fat or cook with fats. The trick is to know the positive and negative aspects about many types of fats and their functions in food. Knowing your fat facts, how to cook with fats, how “bad fats” can be minimized in the diet, and how “good fats” can be incorporated to promote healthy living can minimize the challenges in balancing fats in your diet.

 THINK ABOUT IT

◆ List 3 different types of fats found in food. Indicate whether you think the fats are heart healthy, neutral, or harmful to heart health.

◆ List 3 things you would like to learn about fats or 3 questions you have relating to fats.

1.

2.

3.

LAB ASSIGNMENT:

Frying with Soy Oil

It is estimated that soy oil is the single largest contributor of calories to the American diet. Did you know that hydrogenated oil or shortening is primarily made from soy oil which is often used for frying foods in restaurants and is incorporated into many manufactured food products due to its low cost and quality characteristics? Oil labeled as “vegetable oil” is also primarily made from soy oil. If you look at the Nutrition Facts on the bottle, you will find that soy oil is listed as one of the first ingredients. Because soy oil is so highly utilized in the American diet, the emphasis of this laboratory will be on the principles of soy oil cookery using shortening and vegetable oil. This lab will help you understand frying methods and fat absorption. In addition, some kitchens will experiment with frying various foods to explore the types of foods that can successfully be fried and what types of fried foods consumers may be eating.

Overview:

All students will observe food labels of fat products and record information. Each kitchen will fry the assigned foods and share their resulting products.

Kitchen 1: Chicken strips: Treatment A with Hydrogenated fat at various temperatures (400° Fahrenheit, 365° Fahrenheit, and 325° Fahrenheit)

Kitchen 2: Chicken strips: Treatment A with Vegetable oil at various temperatures (400° Fahrenheit, 365° Fahrenheit, and 325° Fahrenheit)

Kitchen 3: Chicken strips: Treatments B and C with Hydrogenated fat, Vegetable oil, and Lard

Kitchen 4: Potato strips: Treatment A with Hydrogenated fat at various temperatures (325° Fahrenheit, 365° Fahrenheit, and 400° Fahrenheit)

Kitchen 5: Potato strips: Treatment B with Hydrogenated fat, Vegetable oil, and Butter

Kitchen 6: Potato strips: Treatment B with Lard, Margarine, and Canola oil

Kitchen 7: Battered and deep-fried: Onion rings, Pickles, Okra, and Zucchini

Kitchen 8: Battered and deep-fried: Cake roll with cream filling, Chocolate sandwich cookies, Bananas, and Assorted chocolate candies

Evaluation Tools:

- Evaluation of Fats and Oils
- Evaluation of Deep Fried Chicken Strips
- Evaluation of Pan Fried & Oven Fried Chicken Strips
- Evaluation of Deep Fried Potato Strips
- Evaluation of Pan Fried Potato Strips
- Evaluation of Variety of Battered and Deep Fried Products

Directions:

1. Always begin by washing your hands and thoroughly cleaning/sanitizing work surfaces.
2. Gather ingredients needed for your assigned fat recipes/experiments. Review the oil/frying safety tips below.
3. Complete all assigned recipes/experiments.
4. Read the Nutrition Facts label for each fat and oil and complete the “Evaluation of Fats and Oils.”
5. Read “Fat Science” and “Fat Tips for Consumers.” Complete the “Fat Questions.”
6. When your group is finished, taste a small sample of each prepared fried food. Then, complete the evaluation tools.
7. Clean your work station and check out before leaving.

Oil Safety:

Special care should be taken when deep fat frying, as hot oil may cause burns. Note the following safety precautions before starting this experience.

1. Select a small to medium heavy saucepan with vertical sides for frying.
2. Fill the pan with enough oil to cover your food item, but do not fill more than halfway. Leaving extra space at the top of the pan helps protect against burns from bubbling and splattering oil.
3. Clip a candy thermometer or deep fat fry thermometer to the edge of your pan. Be sure to monitor your oil and do not heat above temperatures listed in the directions.
4. Should a small oil fire start, turn off the heat and carefully cover with a non-glass pan lid. If baking soda is handy, douse the fire with baking soda. **DO NOT THROW WATER** on an oil fire as the water will splatter. Do not move the pan. Use a fire extinguisher and/or call 911 if needed.
5. To prevent the hot oil from splashing, use a slotted spoon or tongs to gently add food items to the oil. Do not drop foods into the oil.
6. Use a slotted spoon or tongs to remove food items from the oil.

Oil Disposal Procedures:

Proper disposal of cooking oil is an environmental and waste management concern. The following steps should be followed carefully when disposing used oil.

1. Allow cooking oil to cool completely.
2. Never pour oil down the drain. Never pour oil into the garbage can without first transferring it to a heavy sealable plastic container.
3. Pour cooled oil into heavy sealable plastic containers using a funnel. If it is too difficult to pour the oil into the container from the pot or pan that was used, consider ladling the fat into a measuring cup and then pouring the oil from the measuring cup into the container. Ask your teacher where to locate these containers in the kitchen.
4. If the oil has not cooled enough to put into the plastic container, notify your teacher. They will be able to transfer it to a container at a later time.

RECIPES:

Fried Chicken, Potato Strips & Deep Frying

Chicken Strips

Ingredients:

2 large chicken breasts per group	1 large egg
1 cup milk	2 cups flour
2 teaspoons salt	1/4 teaspoon garlic powder
2 tablespoons paprika	assigned fat

Method:

1. Cut the chicken breasts into 1-inch strips.
2. In a shallow dish or bowl, beat the egg and milk together with a fork. Soak the strips in the mixture for 1-2 minutes.
3. Then, mix the flour, salt, garlic powder, and paprika. Dredge the chicken strips in the flour mixture.
4. Cook the chicken strips using your assigned cooking treatment(s).

Cooking Treatments:

- A. *Deep fried chicken strips:* You will cook 1/3 of your strips at each temperature. Begin by adding 3 to 4 inches of hydrogenated fat or vegetable oil, as assigned, to a small saucepan. Heat to 400° Fahrenheit. Carefully place a reasonable amount of strips into hot fat to fry (avoid overcrowding the pan). Fry until golden brown and the internal temperature reaches 165° Fahrenheit. Remove strips and place on a plate covered with a paper towel. Let oil cool to 365° Fahrenheit and fry additional strips. Cool oil to 325° Fahrenheit and fry remaining strips. Note: Do not discard oil; reuse the same oil for frying at each temperature.
- B. *Pan fried chicken strips:* Barely coat the bottom of a small frying pan (1/4 inch) with lard. Bring to medium heat and place 1/6 of your strips flat in the pan. Cook strips until brown and the internal temperature reaches 165° Fahrenheit (approximately 2 to 3 minutes per side). Repeat using hydrogenated fat and then vegetable oil.

C. *Oven fried chicken strips*: Coat the bottom of a small baking dish (1/8 to 1/4 inch) with melted lard. Place 1/6 of your strips on the baking dish. Bake uncovered at 400° Fahrenheit for 10 minutes. Turn strips over and bake for another 10 minutes or until chicken reaches an internal temperature of 165° Fahrenheit. Repeat using hydrogenated fat and then vegetable oil.

Potato Strips

Ingredients:

1 large or 2 small potatoes	1 large egg
1 cup milk	2 cups flour
2 teaspoons salt	1/4 teaspoon garlic powder
2 tablespoons paprika	assigned fat

Method:

1. Cut the potatoes into 1/8 to 1/4-inch strips. If cut too thick or large, the potato will not cook all the way through.
2. In a shallow dish or bowl, beat the egg and milk together with a fork. Soak the strips in the mixture for 1 to 2 minutes.
3. Then, mix the flour, salt, garlic powder, and paprika together. Dredge the potato strips in the flour mixture.
4. Cook strips using your assigned cooking treatment.

Cooking Treatments:

- A. *Deep fried potato strips*: You will cook 1/3 of your strips at each temperature. Begin by adding 3 to 4 inches of hydrogenated fat to a small saucepan. Heat to 400° Fahrenheit. Carefully place a reasonable amount of strips into the hot fat to fry (avoid crowding the pan). Fry until golden brown. Remove strips and place on a plate covered with a paper towel. Let oil cool to 365° Fahrenheit and fry additional strips. Cool oil to 325° Fahrenheit and fry remaining strips. Note: Do not discard oil; reuse the same oil for frying at each temperature.
- B. *Pan fried potato strips*: Barely coat the bottom of a small frying pan (1/4 inch) with an assigned fat. Bring to medium heat and place strips flat in the pan. Cook strips until done (approximately 2 to 3 minutes per side). Repeat for all assigned fats.

Batter for Deep Frying Vegetables

Ingredients:

Your assigned food items	1 cup milk
1 large egg	2 cups flour
Seasoning of choice, to taste	Fat of choice (vegetable or canola oil preferred)

Method:

1. Cut your assigned food items into reasonable size pieces for frying.
2. In a small bowl, beat the egg and milk together with a fork.
3. In a separate bowl, mix the flour with your choice of seasonings. For vegetables, try strong spices like garlic, paprika, and salt.
4. Next, add 4 inches of fat to a small saucepan and heat to 350° Fahrenheit.
5. Dip each food item into the egg and milk mixture and then into the flour and seasoning mixture. Carefully place the food item into the fat without crowding the saucepan. Fry until all sides are golden brown (approximately 3 to 4 minutes). Place the food item on a plate covered with a paper towel to cool.
6. Allow heat to return to 350° Fahrenheit before frying additional food items.

Batter for Deep Frying Fruits and Sweets

Ingredients:

Your assigned food items	2 large eggs
1 1/2 cups liquid of choice	2 cups flour
2 teaspoons baking powder	1/4 cup sugar
1 teaspoon cinnamon	Fat of choice (vegetable or canola oil preferred)

Method:

1. Cut your assigned food items into reasonable size pieces for frying.
2. In a small bowl, beat the eggs and liquid of your choice together with a fork. Choose a liquid according to desired flavor. Milk, water, or a soft drink will work.
3. In a separate bowl, mix the flour and baking powder together. Combine the flour/baking powder mixture with the liquid/egg mixture to form a batter.
4. Mix the sugar and cinnamon together in a small bowl.
5. Next, add 4 inches of fat to a small saucepan and heat to 350° Fahrenheit.
6. Dip each food item into the batter. Cover the item completely with batter. Carefully place the food item into the fat without crowding the saucepan. Fry until all sides are golden brown (approximately 3 to 4 minutes). Place the food item on a plate covered with a paper towel to cool. Quickly sprinkle with sugar and cinnamon topping.
7. Allow heat to return to 350° Fahrenheit before frying additional food items.

EVALUATION OF FATS AND OILS

Read the Nutrition Facts label for each fat listed below and complete the table.

VARIETY	SERVING SIZE	CALORIES	TOTAL FAT	SATURATED FAT	MONOUNSATURATED FAT	CHOLESTEROL	COST PER SERVING
HYDROGENATED FAT/SHORTENING							
VEGETABLE OIL							
LARD							
BUTTER							
MARGARINE							
CANOLA OIL							

EVALUATION OF DEEP FRIED CHICKEN STRIPS

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numeric score.

VARIETY	APPEARANCE	CRISPNESS	OILINESS	FLAVOR
HYDROGENATED FAT AT 400° F				
HYDROGENATED FAT AT 365° F				
HYDROGENATED FAT AT 325° F				
VEGETABLE OIL AT 400° F				
VEGETABLE OIL AT 365° F				
VEGETABLE OIL AT 325° F				

EVALUATION OF PAN FRIED & OVEN FRIED CHICKEN STRIPS

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numeric score.

VARIETY	APPEARANCE	CRISPNESS	OILINESS	FLAVOR
PAN FRIED HYDROGENATED FAT				
PAN FRIED VEGETABLE OIL				
PAN FRIED LARD				
OVEN FRIED HYDROGENATED FAT				
OVEN FRIED VEGETABLE OIL				
OVEN FRIED LARD				

EVALUATION OF DEEP FRIED POTATO STRIPS

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numeric score.

VARIETY	APPEARANCE	CRISPNESS	OILINESS	FLAVOR
HYDROGENATED FAT AT 400° F				
HYDROGENATED FAT AT 365° F				
HYDROGENATED FAT AT 325° F				

EVALUATION OF PAN FRIED POTATO STRIPS

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numeric score.

VARIETY	APPEARANCE	CRISPNESS	OILINESS	FLAVOR
PAN FRIED HYDROGENATED FAT				
PAN FRIED VEGETABLE OIL				
PAN FRIED BUTTER				
PAN FRIED LARD				
PAN FRIED MARGARINE				
PAN FRIED CANOLA OIL				

EVALUATION OF BATTERED AND DEEP FRIED PRODUCTS

1. Taste each variation and place the numerical score for each characteristic in the upper left hand corner of each box. (Score System: 1=very poor; 2=poor; 3=fair; 4=medium; 5=good; 6=very good; 7=excellent)
2. Provide comments/descriptions to justify the numeric score.

VARIETY	APPEARANCE	CRISPNESS/ TEXTURE	OILINESS	FLAVOR
ONIONS				
PICKLES				
OKRA				
ZUCCHINI				
CREAM FILLED CAKE VARIETY				
CHOCOLATE SANDWICH COOKIES				
BANANAS				
ASSORTED CHOCOLATE CANDIES				

LEARN MORE:

Fat Science

- ◆ Lipids are classified into 3 major groups: **triglycerides**, **phospholipids**, and **sterols**.
- ◆ Fats are solid at room temperature and have high melting points. They typically contain a high proportion of **saturated fatty acids**. Oils are liquid at room temperature and have low melting points. They typically contain a high proportion of **unsaturated fatty acids**.
- ◆ Hydrogenated fats are fats that were once a liquid at room temperature, but hydrogen was added through a process called **hydrogenation** to make it a solid shortening at room temperature instead. These types of fats can produce **trans fats** which increases LDL blood cholesterol and decreases HDL cholesterol.
- ◆ Fats can spoil by a chemical process called **rancidity**. Rancidity is caused by the release of free fatty acids through hydrolysis or by producing free radicals through oxidation. Rancid fats should be discarded.
- ◆ To prevent rancidity, store fats in airtight containers in cool dark storage areas or even in the refrigerator. Reducing exposure to light, heat, and oxygen will extend the life of the fat. Colored glass containers, such as green glass, are known to prevent spoilage by absorbing the type of light that starts oxidation. **Antioxidants** are known to stop oxidative chain reactions and may be added to fats to increase shelf life. The main antioxidants used are vitamins E and C, BHT, BHA, TBHQ, and PG.
- ◆ When a fat is heated too much, it reaches its **smoke point**. At a fat's smoke point, the glycerol is hydrolyzed and fatty acids and acrolein are released. Blue puffs of smoke are visible and the smelly acrolein may irritate mucous membranes such as eyes and nostrils. Fats that are heated beyond their smoke point may reach the **flash point** (small flames in the oil) and then the fire point (oil is ablaze with fire). Before choosing an oil for deep fat frying, the smoke point of the oil should be considered. Factors that decrease the smoke point of oil include repeated or prolonged use, food particles, and surface exposure to oxygen.
- ◆ In food, fat functions include adding flavor and texture, lubricating, emulsifying, and tenderizing. In cooking, fat serves as a medium for transferring heat. For example, when deep fat frying foods, heat is transferred from the source to the pan, then from the pan to the fat, and finally from the fat to the food.
- ◆ In the body, fat supplies energy, transports fat soluble vitamins (A, D, E & K) through the intestinal track, is used to produce hormones, and is necessary for growth, brain functioning, and nerve functioning.

Fat Tips for Consumers

- ◆ The acceptable macronutrient distribution range for total dietary fat is 20-35% of total kilocalories and the American Heart Association recommends that less than 30% of total kilocalories should come from fat. According to the American Heart Association recommendation, a person consuming a 2,000 kilocalorie diet should eat no more than 600 kilocalories from fat a day or no more than 67g of fat a day. Saturated fat should account for 10% or less of total kilocalories. It is recommended that omega-3 fatty acids make up 5-10% of a person's total kilocalories per day.
- ◆ It is important to select fats that fit specific cooking needs. Different fats will be required depending on the cooking method used. For example, fats with a high smoke point, such as vegetable oil, are best when frying food. However, oils with lower smoke points, such as olive oil, work well for salad dressings and mayonnaise.
- ◆ For healthier options, choose fats with the least amount of saturated and trans fats. Look for fats or oils that are rich in unsaturated (mono and poly) and essential (Omega-3 and Omega-6) fatty acids. Olive oil and canola oil are common options that are low in saturated fat and high in monounsaturated fats.
- ◆ Reduce saturated fat intake by purchasing low-fat dairy products and lean meats, by trimming the fat off meats, and by removing the skin from poultry. Using vinaigrette dressings instead of creamy, full-fat dressings can also reduce saturated fat intake. Limit the amount of fried foods and high fat baked goods consumed. In addition, add less butter, margarine, or other fats to prepared foods and when cooking.
- ◆ The amount of fat used during cooking can be reduced by using nonstick pots and pans; roasting, broiling, or grilling instead of frying; using cooking spray; or select herbs and spices for flavoring meals. Reduce the fat in baked goods by replacing some of the fat with applesauce or other fruit puree.
- ◆ Consuming more fish, nuts, olives, and avocados can boost intake of good fats such as omega-3 fatty acids and monounsaturated fats.

Fats Teacher Tips

Overview

This lab requires a lot of attention. Students need to be very careful working with hot oils and pay close attention to detail. It is important for students to understand the proper techniques for putting out a grease fire if the situation where to occur. Students also need to properly dispose of the used oils when cooking is complete.

- ◆ This lab experience will take the full class period of 2 ¼ hours to complete.
- ◆ Students will experiment with different methods of frying foods with oils, hydrogenated fat, lard, margarine, and butter.
- ◆ Students will experiment with different cooking techniques including deep frying, pan frying, and oven frying.
- ◆ Students will experience the sensory characteristics of different frying techniques on a variety of different foods.

Lab Management

Demonstrations

- ◆ Have students calibrate their thermometers. This is a good opportunity to demonstrate and review the proper way to use a thermometer.
- ◆ A video of the proper way to extinguish a kitchen grease fire might also be helpful.
- ◆ If students are not familiar with frying, deep fat fry chicken tenders as a demonstration.
- ◆ A review of proper cutting techniques may also be helpful for students frying foods that need to be cut first.

Time Management

- ◆ Have students cut up everything they need first to save time between frying sessions. This will also prevent the oil from being left on to long between cooking sessions.
- ◆ Have students review proper frying temperatures for their experiments before lab to prevent excess burning.
- ◆ Have students remove oil from the stove top as soon as they have completed the experiment to ensure adequate cooling time for proper disposal of the fat.

Nutrition Points for Discussion:

- ◆ The Dietary Guidelines for Americans recommend decreasing the amount of fat in the diet. This laboratory used a variety of frying methods with different fats. Discuss with students the healthiest way to fry foods.

- ◆ Discuss the function of fat and frying.
 - Frying is a fast way to transfer heat and cook meat. How would the chicken strips fried in lab today be different if they were baked?

- ◆ Discuss the differences between hydrogenated, saturated, and unsaturated fats with students and their effects on the body.
 - In the body, fat supplies energy, transports fat soluble vitamins (A, D, E & K) through the intestinal track, it is used to produce hormones, and is necessary for growth, brain function, and nerve functioning.

SHOPPING LIST: (8 SECTIONS)

Item	Utilized Unit/Lab Section	Purchased Unit
Potatoes	9	9
Onion	1	1
Okra	5	5
Zucchini	2	2
Banana	4	4
Pickle chips	½ jar	1 jar
Assorted candy bars	½ bag	1 sml. bag
Swiss rolls	12	2 boxes
Oreos	24	1 package
Garlic powder	1 tsp.	1 cont.
Paprika	8 TBSP	1 cont.
Flour	8 lbs	(1) 5 lb bags
Salt	4 TBSP	1 cont.
Vegetable Oil	14 ½ cups	2 gal.
Canola oil	7 cups	1 gal.
Crisco	64 oz	2 cans
Lard	28 oz	1 cont.
Butter	8 oz	1 block
Margarine	8 oz	1 box
Eggs	16	(1) 18 count
Milk	8 ½ cups	1 gal.
Chicken breast	24	24
Frying thermometers	8	8