Plants: The Ultimate Green Machines
Science, Grade Level 7

Knowing is not enough; we must apply. Willing is not enough; we must do.
– Goethe

As a powerful 7th grade instructor, you want to teach this lesson because

- Seventh graders do not find food production and storage in plants as interesting and fun as biologists do.
- Students love doing anything with food, and this is more than just fun. It’s meaningful. Students use science process and procedure to study the products of photosynthesis.
- Calories in = calories out is a seemingly simple equation that we are failing to solve on a national level.
- Every experience a child has with eating fresh vegetables increases the probability that they will one day be best friends.
- You give students the opportunity to understand that people don’t feed plants; plants make their own food and healthy people eat foods made by plants.
- Knowing is not enough . . .

Grade Level Expectation (s):
- L.OL.07.63 Describe evidence that plants make, use, and store food.
- S.IP.07.11 Generate scientific questions based on observations, investigations, and research.
- S.IP.07.12 Design and conduct scientific investigations.
- S.IA.17.13 Communicate and defend findings of observations and investigations.

MNN Behavioral Outcomes:
- Eat fruits and vegetables, whole grains, and fat-free or low-fat milk products every day.

SNAP-Ed Core Nutrition Messages:
• Snack like a super hero
• Fuel up with fruit and veggies

**Type of Gardening Experience:**
• Growing plants

**Goal:**
• To conduct an experiment to show evidence that plants, unlike any other living organisms, have the ability to make, use, and store their own food.

**Learning Objectives:**
The students will…
• Conduct an experiment to identify plants and plant parts that contain carbohydrates/starch (stored glucose, also known as sugar)
• Explain why all plant based foods contain carbohydrates/starch
• Understand why dietary fiber is not a form of energy

**Background**
Sugars, starches, and fiber all belong to the same macronutrient category called carbohydrates. Carbohydrates are made from the three elements: carbon, hydrogen and oxygen. “Carbo-“ means carbon, “-hydrate” means water, \( \text{H}_2\text{O} \) There are two forms of carbohydrates. “Simple” sugars are monosaccharides consisting of one sugar unit of glucose, fructose or galactose; disaccharides have two sugar units linked together chemically: glucose + fructose = sucrose; glucose + galactose = lactose; glucose + glucose = maltose) and “complex” starches (longer chains of sugar molecules.

As energy units, sugars and starches are the human body’s main fuel source. Humans store energy in their bodies in the form of blood glucose and glycogen (a polysaccharide storage form of glucose stored in muscle and liver cells). Glucose is a single unit of sugar that is easily broken down in cells by a process called glycolysis. Carbohydrates from either simple or complex sources provide 4 calories per gram. While your body also derives energy from protein and fat sources, it is not as efficient as energy derived from carbohydrates. Protein should be spared for body maintenance and repair. In a “low carb” high fat diet, fat becomes an energy source; in the process, however, potentially harmful ketones can build up in the blood which is not healthy over time. Complex carbohydrates/starches come from plant based foods such as rice, pasta, potatoes, beans, and grain products.

Photosynthesis- Plants are energy producers; they use the energy from light to make sugar molecules from atoms of carbon dioxide and water. Plants use these sugars, along with minerals from the soil, to form fats, proteins, and carbohydrates. These products can be used immediately, incorporated into the cells of a plant as the plant grows, or stored for later use. (http://michigan.gov/documents/mde/7-Science_COMPLETE_12-10-07_218322_7.pdf)

**Vocabulary**
• **Carbohydrate** - any compounds that form sugars, starches, or the supporting tissues of plants.
• **Starch** – the storage form of carbohydrate in plants; an important food source; a solid carbohydrate found in small granules in various parts of plants; the storage form of glucose produced by plants
• Photosynthesis – the process where a plant takes in carbon dioxide and water and, using energy from the sun inside the chlorophyll, produces oxygen and glucose (sugar), which can then be used or stored by the plant.

Note: plants have the unique ability to change their carbohydrates. As a fruit matures, its carbohydrates change from starch to simple sugar.

Advanced Preparation
• Set up a lab station for each team of students.
  o Cut up raw foods and place a small sample piece of each food at each lab station
  o One bottle of iodine with dropper per station
  o 1 white paper plate per station

Supplies
• Iodine with dropper
• Raw Foods – potato, carrot, corn, celery, lettuce, cauliflower, tomato, bean
• White paper plates
• Cups (for holding produce)
• MyPyramid for Kids poster OR MyPyramid poster. http://teamnutrition.usda.gov/educators.html (Teacher note: MyPyramid for Kids is for children 6-11 years. If the majority of your class is over 11 years of age use the adult MyPyramid.)

Safety Notes
• Iodine stains clothing, skin, and worktop surfaces, so be careful!

Procedures

Step 1
• Ask students where their food comes from (a box?). (eating plants and animals, grocery store, garden, parents)
• Ask students where animals get their food. (hunt/other animals, forage/plants, we feed them) Previous knowledge: food web, consumers, producers
• Ask students where plants get their food. (Students may respond that plant food is soil or water. This is a common misconception.)
• Explain that soil is not plant food nor is water or anything else. Plants are actually the only living things that make their own food, and they do it through the process of photosynthesis.

Step 2
• In groups of 4 or 5, have students discuss what they know about photosynthesis and how plants work.
• After a few minutes, ask each group to report what they discussed.
• Discuss common themes that are mentioned (Example: take in carbon dioxide, release oxygen, need sunlight, soil, and water, etc.)

Step 3
• Show students the equation for photosynthesis and review how it works.

sunlight
Carbon dioxide + water ---------------------------→ oxygen + glucose (natural sugar)

chlorophyll

A plant takes in carbon dioxide and water and, using energy from the sun inside the chlorophyll, produces oxygen and glucose (sugar) which can then be used or stored by the plant.

**Step 4**
- Explain that according to this explanation of photosynthesis, plants produce oxygen and glucose.
- Ask students, “According to what we already know about plants, what happens to the oxygen produced during photosynthesis?” (Oxygen is a waste product during photosynthesis. Animals (including people) benefit from it, but are not the reason plants make oxygen. CO₂ is a byproduct of respiration (both plants and animals do this)
- Ask students, “What happens to the glucose?” Allow students to share ideas.
- Explain that plants can either use the glucose or store it.
- Ask “What are some ways a plant would use glucose?” (for growth and repairing damage)
- Explain that when glucose is stored by plants, we call it starch, and starch is a form of carbohydrate, a macronutrient our body needs.
- Ask students if they recognize the term carbohydrates and what they associate with it. (It’s in our food. Many diets encourage increasing the amounts of complex carbohydrates and decreasing simple sugars; other diets call for reducing the intake of carbohydrates altogether. Athletes may “carbo load” before an endurance event for energy to perform their best.)

**Step 5**
- Show students the MyPyramid poster. Where are starches located within the graphic? (grains, vegetables, fruits, beans) Explain that the students are growing starch in the school garden. Have students harvest sample vegetables to use in an experiment which determines where plants store carbohydrates.
- Distribute the Lab Report worksheet.
- Read over the objective and steps 1-3 with the class, pausing to allow students to make their own hypotheses.

**Step 6**
- Put students into lab groups and allow them to conduct the experiment and complete the lab report.

**Step 7**
- Mix up the groups and have students discuss their results with students from other lab groups. Were the results the same?
- Have students discuss their explanations of their results in their groups.
- Have students share results and explanations with the class.

**Step 8**
- Explain that the results should have shown the presence of starch/carbs in all the foods tested because…
  - All plants make and store their own food.
Plants store large amounts of starch in different structures, depending on the type of plant. The part of the plant that becomes enlarged is storing the most starch, which is why we eat that part.

**Step 9**
- Talk about new questions students developed in #6 of their lab reports.
- Invite students to write their questions on a bulletin board or chart paper under the heading, "I wonder what would happen if…".

**Assessment**
- Satisfactory completion of lab report; correctly drawn conclusion.
- Ability to give a detailed explanation of the storage of carbohydrates produced in photosynthesis.

**Student Pages**

**CARBOHYDRATES LAB REPORT**

Objective: To use the scientific method to identify plants and plant parts that contain carbohydrates/starch (stored sugar).

1. Ask a Question:  1) What plant parts are used for storage? What plant parts that eaten by people are used to store glucose?

2. Research:  This would be the activities in Steps 1-4 above.

3. Hypothesis:
   a. Use the chart below to make your predictions: I predict that the **roots, stems, leaves, flowers, and or fruit** of __________store(s) glucose as starch and will test positive for carbohydrates.

<table>
<thead>
<tr>
<th>roots</th>
<th>stems</th>
<th>leaves</th>
<th>flowers</th>
<th>fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>potato</td>
<td>carrot</td>
<td>corn</td>
<td>celery</td>
<td>lettuce</td>
</tr>
<tr>
<td>cauliflower</td>
<td>tomato</td>
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</tbody>
</table>

   b. I predict that the different plant structures above will have (circle one) **about the same, very different** amounts of carbohydrates.
4. Experiment: We will test potatoes, carrots, corn, celery, lettuce, cauliflower, and tomato for the presence of starch/carbohydrates. (Plants will be grown in the garden and harvested for this investigation)

Use plants from the garden.

a. Using the dropper, place a tiny drop of iodine on each food item.
b. Using a popsicle stick or toothpick, rub the food onto the white paper plate to allow the color to show. Switch to a clean rubbing tool each time you test a new vegetable. If you have a camera available, take pictures to document the color changes for later discussion.
c. Brown indicates no change and thus no starch/carbs. Purple indicates the presence of starch/carbs. Estimate the amount of carbohydrate in each food item by determining whether it was easy (high amounts of starch present) or difficult (low amounts of starch present) to observe the color change to purple.

5. Collect Data:

<table>
<thead>
<tr>
<th>Item Tested</th>
<th>Part of Plant</th>
<th>Starch/Carbs Present</th>
<th>NO Starch/Carbs</th>
<th>Relative amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Starch easily observed</td>
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6. Explain Data:
Categorize plants / plant parts.

Do your results support your hypothesis?

Why or why not?

Do you think the starch in one plant’s storage system is the same as the starch in another plant’s storage system?

Why might it sometimes be difficult to see the purple color appear in the presence of starch?

7. Ask New Questions:

What new questions do you have based on what you just did in this experiment?
What should the next carbohydrates experiment be?

8. Follow Through:
Make the most out of this lesson and experiment by completing an activity about carbohydrates: 
*Keep It Real; Keep It Green*
**Keeping It Real, Keeping It Green**  
Plants the Ultimate Green Machine  
Grade Level 7

You are now a skilled lab technician who knows how to test for the presence of starch. You may even know how to test for the presence of sugar. There’s a very good chance that you know carbohydrates are found on MyPyramid in the vegetables, fruits, grains, milk products, and beans. (Boom! That’s every category.) These foods offer energy from the carbs in them, but they also contain vitamins, minerals, fiber, water, and sometimes even protein.

**Do all carbohydrates offer great nutrition?** Take a look at the list below. Every item on the list is made from carbohydrates. You’ve probably tasted most of them at some time. In fact, some of them are perfect fuel sources that give us nutrients along with energy. Others might be fun to eat, but because they lack nutrients, they are not the best fuels for us; we say that those foods have empty calories. As you read through the list, you’ll be selecting from four categories to classify each item listed: 1) Has calories and nutrients; 2) Has calories but not many nutrients; 3) Part of a healthy diet; and 4) It’s better not to eat this or to eat only limited amounts of it. Three examples have been done for you.

**Are you planning to slack off** and just guess your way through the chart? Don’t! Instead, refer to the nutrition charts you’ve been given to help you make good decisions. Be prepared to explain your choices.

<table>
<thead>
<tr>
<th>Items made of carbohydrates</th>
<th>Has calories and nutrients</th>
<th>Has calories but not many nutrients</th>
<th>Part of a healthy diet</th>
<th>Should not eat</th>
<th>Eat limited amounts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumber</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Animal Crackers</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Cotton T-Shirt</td>
<td>X</td>
<td></td>
<td>X</td>
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<tr>
<td>Celery</td>
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<tr>
<td>Bread</td>
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<tr>
<td>Fruit Life Savers</td>
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<td>Cardboard</td>
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<tr>
<td>Chocolate Fudge</td>
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<tr>
<td>Peanut butter</td>
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<tr>
<td>Popcorn</td>
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<tr>
<td>Yogurt</td>
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<tr>
<td>Baked beans</td>
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<td></td>
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<tr>
<td>Cotton candy</td>
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<tr>
<td>French fries</td>
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<tr>
<td>Mountain Dew</td>
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</tbody>
</table>
**Take a moment to look for patterns** in the chart you just completed. What common traits do you see in the items you classified as “Eat in limited amounts”?

________________________________________________________________________

Pick one of the items from “Eat in limited amounts.” At some point, it must have come from food stored by a plant, and that would have been a healthy part of your diet. What do you think happened to change that?

________________________________________________________________________

A good real life example of this is carrots and carrot cake. Why would these two foods end up in different categories?

________________________________________________________________________

How does MyPyramid warn us about foods that we must limit? (To answer this question, find a little message on MyPyramid.)

________________________________________________________________________

**Finally, write a few lines to show your understanding** of the connection between carbohydrate storage in plants and the information on MyPyramid.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

*If you’ve done an excellent job on this, maybe you should celebrate with a MyPyramid carbohydrate feast!*
<table>
<thead>
<tr>
<th>Food</th>
<th>Nutrition Facts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal Crackers</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 1 shoebox&lt;br&gt;Amount Per Serving&lt;br&gt;Calories: 10&lt;br&gt;Calories from Fat: 10%&lt;br&gt;Total Fat: 0.0 g&lt;br&gt;Saturated Fat: 0.0 g&lt;br&gt;Trans Fat: 0.0 g&lt;br&gt;Cholesterol: 0 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 2 g&lt;br&gt;Dietary Fiber: 0.0 g&lt;br&gt;Sugars: 0.0 g&lt;br&gt;Fiber: 0.0 g&lt;br&gt;Protein: 0.0 g&lt;br&gt;Vitamin A: 0%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Baked Beans</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 1 cup (269 g)&lt;br&gt;Amount Per Serving&lt;br&gt;Calories: 150&lt;br&gt;Calories from Fat: 20%&lt;br&gt;Total Fat: 2.0 g&lt;br&gt;Saturated Fat: 0.6 g&lt;br&gt;Trans Fat: 1.4 g&lt;br&gt;Cholesterol: 20 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 18 g&lt;br&gt;Dietary Fiber: 2.0 g&lt;br&gt;Sugars: 3.2 g&lt;br&gt;Protein: 1.6 g&lt;br&gt;Vitamin A: 2%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Bread</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Per 2 slices (64 g)&lt;br&gt;Amount: 140&lt;br&gt;Calories from fat: 2%&lt;br&gt;Total Fat: 1.5 g&lt;br&gt;Saturated Fat: 0.3 g&lt;br&gt;Trans Fat: 0.5 g&lt;br&gt;Cholesterol: 0 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 26 g&lt;br&gt;Dietary Fiber: 2.0 g&lt;br&gt;Sugars: 2 g&lt;br&gt;Protein: 5 g&lt;br&gt;Vitamin A: 0%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 4%&lt;br&gt;Iron: 10%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Cardboard</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 1 shoebox&lt;br&gt;Amount Per Serving&lt;br&gt;Calories: 0&lt;br&gt;Calories from fat: 0%&lt;br&gt;Total Fat: 0.0 g&lt;br&gt;Saturated Fat: 0.0 g&lt;br&gt;Trans Fat: 0.0 g&lt;br&gt;Cholesterol: 0 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 7 g&lt;br&gt;Dietary Fiber: 2 g&lt;br&gt;Sugars: 0 g&lt;br&gt;Protein: 0 g&lt;br&gt;Vitamin A: 0%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Chocolate Fudge</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 1 sleeve&lt;br&gt;Amount Per Serving&lt;br&gt;Calories: 0&lt;br&gt;Calories from fat: 0%&lt;br&gt;Total Fat: 0.0 g&lt;br&gt;Saturated Fat: 0.0 g&lt;br&gt;Trans Fat: 0.0 g&lt;br&gt;Cholesterol: 0 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 7 g&lt;br&gt;Dietary Fiber: 0 g&lt;br&gt;Sugars: 0 g&lt;br&gt;Protein: 0 g&lt;br&gt;Vitamin A: 0%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Celery</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 5 Sticks (85 g)&lt;br&gt;Amount Per Serving&lt;br&gt;Calories: 10&lt;br&gt;Calories from fat: 0%&lt;br&gt;Total Fat: 0 g&lt;br&gt;Saturated Fat: 0 g&lt;br&gt;Trans Fat: 0 g&lt;br&gt;Cholesterol: 0 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 15 g&lt;br&gt;Dietary Fiber: 2 g&lt;br&gt;Sugars: 0 g&lt;br&gt;Protein: 0 g&lt;br&gt;Vitamin A: 0%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 4%&lt;br&gt;Iron: 10%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Cotton Candy</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 1/2 cup (115.0 g)&lt;br&gt;Amount Per Container&lt;br&gt;Calories: 250&lt;br&gt;Calories from fat: 7%&lt;br&gt;Total Fat: 14.0 g&lt;br&gt;Saturated Fat: 9.0 g&lt;br&gt;Trans Fat: 0.0 g&lt;br&gt;Cholesterol: 35.0 mg&lt;br&gt;Sodium: 75.0 mg&lt;br&gt;Total Carbohydrates: 20.0 g&lt;br&gt;Dietary Fiber: 0.0 g&lt;br&gt;Sugars: 25.0 g&lt;br&gt;Protein: 4.0 g&lt;br&gt;Vitamin A: 10%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 15%&lt;br&gt;Iron: 0%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Vitamin A: 10%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 15%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
<tr>
<td>Cotton T-Shirt</td>
<td><strong>Nutrition Facts</strong>&lt;br&gt;Serving Size: 1 sleeve&lt;br&gt;Amount Per Serving&lt;br&gt;Calories: 0&lt;br&gt;Calories from fat: 0%&lt;br&gt;Total Fat: 0.0 g&lt;br&gt;Saturated Fat: 0.0 g&lt;br&gt;Trans Fat: 0.0 g&lt;br&gt;Cholesterol: 0 mg&lt;br&gt;Sodium: 0 mg&lt;br&gt;Total Carbohydrates: 0 g&lt;br&gt;Dietary Fiber: 0 g&lt;br&gt;Sugars: 0 g&lt;br&gt;Protein: 0 g&lt;br&gt;Vitamin A: 0%&lt;br&gt;Vitamin C: 0%&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;<strong>% Daily Value</strong>&lt;br&gt;Calcium: 0%&lt;br&gt;Iron: 0%&lt;br&gt;</td>
</tr>
</tbody>
</table>
| Cucumber            | **Nutrition Facts**<br>Serving Size: 1 pepper (100)<br>Amount Per Serving<br>Calories: 0<br>Calories from fat: 0%<br>Total Fat: 0.0 g<br>Saturated Fat: 0.0 g<br>Trans Fat: 0.0 g<br>Cholesterol: 0 mg<br>Sodium: 0 mg<br>Total Carbohydrates: 0 g<br>Dietary Fiber: 0 g<br>Sugars: 0 g<br>Protein: 0 g<br>Vitamin A: 0%<br>Vitamin C: 0%<br>Calcium: 0%<br>Iron: 0%<br>**% Daily Value**<br>Calcium: 0%<br>Iron: 0%<br>
### Nutrition Facts

**French Fries**

**Nutrition Facts**

**Serving Size:** 1 Lifesaver

**Amount Per Serving**

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<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Calories</td>
<td>10</td>
</tr>
<tr>
<td>Calories from fat</td>
<td>0.0 g</td>
</tr>
<tr>
<td>Total Carbohydrates</td>
<td>2 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0 g</td>
</tr>
</tbody>
</table>

**Vitamin A** 0%  
**Vitamin C** 0%  
**Calcium** 0%  
**Iron** 0%

**Peanut Butter**

**Nutrition Facts**

**Serving Size:** 10 Cal Bq

**Amount Per Serving**

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<table>
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<tbody>
<tr>
<td>Calories</td>
<td>110</td>
</tr>
<tr>
<td>Calories from fat</td>
<td>0.0 g</td>
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<tr>
<td>Total Carbohydrates</td>
<td>31 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0 g</td>
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**Vitamin A** 0%  
**Vitamin C** 0%  
**Calcium** 0%  
**Iron** 0%

**Popcorn**

**Nutrition Facts**

**Serving Size:** 8 fl oz.

**Amount Per Serving**

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<tbody>
<tr>
<td>Calories</td>
<td>10</td>
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<tr>
<td>Calories from fat</td>
<td>0.0 g</td>
</tr>
<tr>
<td>Total Carbohydrates</td>
<td>2 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0 g</td>
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</tbody>
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**Vitamin A** 0%  
**Vitamin C** 0%  
**Calcium** 0%  
**Iron** 0%

**Mountain Dew**

**Nutrition Facts**

**Serving Size:** 1 Lifesaver

**Amount Per Serving**

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<tbody>
<tr>
<td>Calories</td>
<td>10</td>
</tr>
<tr>
<td>Calories from fat</td>
<td>0.0 g</td>
</tr>
<tr>
<td>Total Carbohydrates</td>
<td>2 g</td>
</tr>
<tr>
<td>Protein</td>
<td>0 g</td>
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**Vitamin A** 0%  
**Vitamin C** 0%  
**Calcium** 0%  
**Iron** 0%

**Yogurt**

**Nutrition Facts**

**Serving Size:** 1 container (170g)

**Amount Per Serving**

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<table>
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<tbody>
<tr>
<td>Calories</td>
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<td>Calories from fat</td>
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<tr>
<td>Total Carbohydrates</td>
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</tr>
<tr>
<td>Protein</td>
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</tr>
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</table>

**Vitamin A** 0%  
**Vitamin C** 0%  
**Calcium** 20%  
**Iron** 0%

### Notes

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

- An excellent extension of this lesson is to take an entire potato plant (or other food plant such as a carrot), and test the main parts of the plants for presence of starch. Students should see that potatoes store starch in their tubers, carrots in their roots, peas in their seed pods, etc.
- Have students test kitchen food products for starch. (Baking powder, flour, corn starch)
- Cook food samples like the ones in the experiment and test them again for starch.
- Enjoy some big plates of vegetables while finishing this experience – some cooked, some raw.
- Have the instructor demonstrate a Benedict’s test for sugars, which indicates concentration levels of sugar. Then test the cooked vegetables with Benedict’s solution to see if the cooked vegetables show a sugar reaction.
- Have students bring in food bits to class to test with the Benedict’s solution.
- Test an un-chewed and a chewed cracker with Benedict’s solution.
- Use protein test strips, available from Carolina Biological Supply online, to test almonds and dried beans for protein.
- Use New Questions from #6 above to develop and conduct new experiments.

Supporting Resources

- Primer on starch production and storage: http://pslc.ws/macrog/kidsmac/starch.htm
- This piece from Annenberg Media explains the sugar-starch relationship and the storage of food in plants: http://www.learner.org/workshops/sheddinglight/highlights/highlights5.html

Teacher Resources

- This site explores a common misconception about crackers, chewing, and starch tests. It then offers up a cool alternative to show the principle of detecting a change from starch to sugar through the work of saliva: http://www.exploratorium.edu/ti/conf/nsta2009/karen/bogus_biology.pdf
- This article from the BBC home site describes the value of unprocessed grains over refined ones: http://www.bbc.co.uk/health/healthy_living/nutrition/healthy_carbos.shtml#refined_and_unrefined_grains
- Production of fuels from the carbohydrates plants make is described: http://www1.eere.energy.gov/biomass/abcs_biofuels.html

Literature

Websites

- https://www.bcmsc.k12.mi.us/

Interactive Technology Opportunities