Food for Keeps

Objective

Students will read about several different methods of food preservation and reinforce related vocabulary. Students will make beef jerky and/or fruit leather. Students will conduct taste tests of different kinds of processed foods, collect data, graph the results and compute simple probabilities.

Background

Eating healthy is a matter of choice for most of us today, but it wasn't so simple for early American colonists. We know that a healthy diet includes eating plenty of fresh fruits and vegetables and that we can usually get some variety of these at the grocery store. But early Americans could only get fresh fruits and vegetables during the growing season. There were no refrigerated rail cars or trucks to bring food from more temperate climates. For the rest of the year they had to rely on food preservation techniques that were difficult and time-consuming.

Methods available for preserving food included drying, salting, sugaring, pickling and cold storage. These methods had been developed through trial and error, but no one knew exactly why they worked. Bacteria had not yet been discovered.

We now know that drying, salting and sugaring reduce the activity of water. This inhibits the growth of bacteria and the activity of internal enzymes that cause food spoilage. Acidification and salting inhibit the growth of many spoilage bacteria, and the low temperatures in cold storage slow down their reproductive rate.

English Language Arts

1. Read and discuss background and vocabulary.
2. Hand out copies of the Reading Page.
   —Students will read independently or as a class.
   —Students will discuss scientific reasons for why the different methods of food preservation work.
3. Hand out the student worksheet.
   —Students will match the food preservation method with the correct definition.
4. Students will use internet search engines or library references to research favorite foods and determine the methods used for processing them.
   —Students will present their research to the class.

Science

1. Bring an assortment of fresh foods, along with their processed counterparts (beef/beef jerky, pork/bacon, chicken/canned chicken, grapes/raisins, fresh beets/canned beets, etc.) Seal raw meat in plastic bags so students can see it but not handle it.
   —Students will match the fresh food with the processed food.
   —Students will compare and contrast fresh with processed.

Oklahoma Academic Standards

GRADE 6
English Language Arts—1.R.1,3; 3.R.7; 4.R.1,3,4,5; 6.R.1,2,3; 7.R.1,2; 1.W.1,2; 3.W.2; 6.W.1,2,3,4; 7.W.1,2
Science—PS3.3
Math—D.1.1,2; 2.1,2,3

GRADE 7
English Language Arts—1.R.1,3; 3.R.7; 4.R.1,3,4,5; 6.R.1,2,3; 7.R.1,2; 1.W.1,2; 3.W.2; 6.W.1,2,3,4; 7.W.1,2
Science—PS1.2
Math—D.1.1,2; 2.1,2,3

GRADE 8
English Language Arts—1.R.1,3; 3.R.7; 4.R.1,3,4,5; 6.R.1,2,3; 7.R.1,2; 1.W.1,2; 3.W.2; 6.W.1,2,3,4; 7.W.1,2
Science—PS1.3
Pre-Algebra—D.1.3; 2.1

Materials

assorted fresh foods and their processed counterparts—fresh and canned fruit or vegetables, raisins, beef and summer sausage, frozen food, freeze-dried food, etc.

very lean flank steak, partially frozen

teriyaki sauce

gloves for food handling
assorted fresh fruit for drying—apples, peaches, apricots, plums, grapes, etc.

Vocabulary

acidification—to turn something acid
brine—water saturated with a large amount of salt
canning—the act, process or business of preserving food in airtight containers
contamination—an unclean or impure state
cold storage—a protective storage for foods in a refrigerated place
drying—to preserve by extracting the moisture
freezing—the lowering of the temperature of food to temperatures below 28 degrees F
irradiation—the act of subjecting something to radiant energy in the form of waves or particles
microbial—a microscopic organism, especially one that transmits a disease
osmosis—the defusion of fluid through a semipermiable membrane until there is equal concentration
pasteurization—the process used to destroy harmful organisms in milk
pemmican—a food made chiefly from beef, dried fruits, and suet (the hard fat around the kidneys in beef and mutton from which tallow is made)
pickling—a solution of brine or vinegar often spiced for flavoring foods
preservation—to prepare food for future use by canning or salting
refrigeration—to preserve food by chilling
rosin—a yellowish—brown sap from various pine trees
salting—to cure or preserve using a salt mixture
saltpeter—potassium nitrate
scaffold—a raised wooden framework or platform
sugar—a sweet crystalline carbohydrate sucrose

2. Divide students into groups.
   —Students will experiment with drying fruit and other foods, using a food hydrator, a microwave oven, a conventional oven and air drying.
   —Students will design their own experiments, under adult supervision.
   —Students will review and observe safety rules.
   —Students will explain their procedures, including the reasons these methods work for food preservation, and report findings to the other groups.
3. Students will make beef jerky and/or fruit leather, using the recipe included with this lesson.
4. Students will make pemmican, as described in the reading, by pounding some of the jerky with the dried fruit and dividing it into plastic bags.
5. Students will bring examples of processed food from home and identify the method of processing used.

Math

1. Conduct a tasting party with an assortment of processed foods.
   —Students will conduct surveys to determine which food tastes best to the largest number of students.
   —Students will graph results of the survey.
   —Students will compute simple probabilities as fractions, decimals or percents.

Extra Reading

Ceffrey, Holly, *The Inventions of Amanda Jones: The Vacuum Method of Canning and Food Preservation (19th Century American Inventors)*, PowerKids, 2003.

Fandel, Jennifer, *Louis Pasteur and Pasteurization,* Capstone, 2007.

Mecozzi, Maureen, *The Uncanny Can (Shockwave: Science)*, Children's, 2007.

Reilly, Kathleen, and Samuel Carbaugh, *Food: 25 Amazing Projects: Investigate the History and Science of What We Eat (Build it Yourself Series)*, Nomad, 2010.

Answers for Student Worksheet A

1. raisins, beef jerky; 2. ham, pickles; 3. yogurt, cheese; 4. bacon; 5. canned fruit, ketchup; 6. milk; 7. lettuce; 8. frozen peas; 9. coffee; 10. frozen orange juice; 11. ground beef.

Reading Page

Food for Keeps

Eating healthy is a matter of choice for most of us today, but it wasn't so simple for early Americans. We know that a healthy diet includes eating plenty of fresh fruits and vegetables and that we can usually get a variety of these at the grocery store year round. Early Americans could only get fresh fruits and vegetables during the growing season. There were no refrigerated rail cars or trucks to bring food from more temperate climates. For the rest of the year they had to rely on food preservation techniques that were difficult and time-consuming.

DRYING OR SMOKING

One of the most ancient methods of food preservation is sun- or air-drying. Drying works because it removes much of the food's water. Without adequate water, microorganisms cannot multiply and chemical activities greatly slow down. Dried meat was one of the earliest staple foods of hunters and nomads (people who constantly moved about). Once fire was discovered, prehistoric cave dwellers heat-dried meat and fish, which probably led to the development of smoking as another way to preserve these foods.

Drying was a technique used by early American colonists to preserve apples, peaches, pears and apricots along with some vegetables, meat and fish. Nets woven of hair were used to support the fruit or fish and allow good air circulation. The food had to be turned frequently and protected from insects, bird droppings and blowing dirt.

The tribes of the American Great Plains developed their own method for drying bison meat. This provided a safe food supply through the long periods between hunting seasons. After eating their fill of the fresh bison meat, the Indians would take the remaining meat and make pemmican. They would slice the meat thin and hang it on scaffolds. They hung streamers along with the meat, so they would blow in the wind and keep wolves away. Once the meat was dry they pounded it and placed it in buffalo rawhide bags about the size of a pillow case. Sometimes they added dried berries for flavor. The sugar from the berries also helped with preservation. They poured hot melted marrow in so that it surrounded each particle of meat. Then they sewed the bag shut. Before the contents became hard from cooling, they walked on it to flatten it. A single sack weighed close to 90 pounds and could be placed across small logs or rocks to keep them off the damp ground.

SALTING

Salting, which also inhibits bacteria growth, was a preferred method of preserving fish as early as 3500 B.C. in the Mediterranean world, and also was practiced in ancient China. Early American colonists used salt to preserve pork, beef or fish and some cheese. These foods often provided the only animal protein available during the winter other than wild game.

Hog butchering was done in the fall, as soon as it was cold enough to chill the carcass rapidly. A certain amount of the meat was reserved fresh, for immediate use, and some was made into sausage. The rest, especially the hams (hind legs) and side meat, was treated with salt containing saltpeter (potassium nitrate). This was stored until it had lost a great deal of water through osmosis. It was then exposed to hickory or fruit-wood smoke for several days. After that it was hung in a ventilated shed or barn for 6-18 months as it gradually lost moisture.

Substances besides salt were also found to slow food spoilage by ancient cultures. The Chinese began using spices as preservatives around 2700 B.C. Ancient Egyptians used mustard seeds to keep fruit juice from spoiling. Jars of fruit preserved with honey have been found in the ruins of Pompeii, Italy. Melted fat—as Native North Americans discovered with pemmican—preserved meat by sealing out air.

SUGARING

As a preservative, sugar acts like salt in reducing water activity enough to prevent the growth of spoilage bacteria. early settlers used sugar to preserve fruits for winter use. the fruits were boiled with sugar, and the containers were sealed with beeswax or a mixture of candle wax and rosin. Sometimes a piece of paper would

be pasted to the top of the jar with egg white. Sugar was also used as a preservative in meat preparations.

PICKLING OR BRINING

Fruits and vegetables were the most difficult foods to get out of season. Pickling or brining was a fairly simple way to preserve vegetables without changing their flavor too much. The vegetables were submerged in a mild salt and vinegar brine in a crock.

COLD STORAGE

Early northern societies quickly learned that coolness as well as freezing helped preserve foods. Microbe growth and chemical changes slow down at low temperatures and completely stop when water is frozen. Pre-Columbian natives in Peru and Bolivia freeze-dried potatoes, while the early Japanese and Koreans freeze-dried their fish. Water evaporating through earthenware jars was used as a coolant in 2500 B.C. by Egyptians and East Indians. Ancient Chinese, Greeks, and Romans stored ice and mountain snow in cellars or icehouses to keep food cool.

Cold storage was possible in the northern US. root cellars, in which the winter temperatures hovered between 30 and 40 degrees F., were common. In especially cold weather, a large tub of water was placed on the floor. This water gave off heat as it turned to ice, keeping the vegetables from freezing. If a family didn't have room for a root cellar, a pit served much the same purpose. Vegetables were laid in layers, separated by straw, and the whole was covered with earth. Ice houses were the first refrigerators. During the winter, these above-ground houses were filled with blocks of ice cut from streams and lakes and packed in sawdust for insulation. the ice could then be delivered to homeowners during the spring and summer.

The ice was used to keep dairy products, fish and meat from spoiling. The ice box did not become popular until the mid-1800s. It had to be recharged frequently with a new block of ice. Although settlers in the South had access to a more varied food supply year round, they had more difficulty getting ice for short term protection against the warmer climate. Ice was shipped from Massachusetts to the southern states in the early 19th century, but because of the cost it was available only to wealthier people. Eggs could be stored in the root cellar or basement. the eggs were dipped in boiling water for 20 seconds then coated all over with butter or glycerin and packed in sawdust. they would keep this way for 2-3 weeks.

CANNING, FREEZING AND REFRIGERATION

The invention of canning created a revolution in food preservation and availability. The development of commercial freezing and refrigeration made preservation of fresh meat possible. Refrigerated rail cars, then refrigerated trucks, also increased the availability of fresh fruits and vegetables.

PASTEURIZATION

Microbial contamination of dairy products led to widespread use of pasteurization in these foods. Louis Pasteur had perfected this method to save the wine industry in France in the late 1870s. It involved heating to reduce the number of disease producing bacteria.

IRRADIATION

One of the most recently developed food preservation methods is irradiation. irradiation kills e coli, a deadly bacteria found in beef and other foods. Irradiation pasteurizes food by using energy, just as milk is pasteurized using heat. irradiation destroys insects, fungi, or bacteria that cause spoilage and human disease. During irradiation, energy passes through food much like a ray of light passes through a window. This energy destroys most of the bacteria that can cause disease yet allows food to retain its high quality. Hospitals use irradiation to sterilize food for patients with weak immune systems, and astronauts have eaten irradiated foods for many years. Today's processed foods retain most of their nutritive value during processing, and in most cases the loss of nutrients due to processing is less than loss from cooking.

Sources: Mattson, Howard W., "Potted, Pickled and Ill-Preserved," *Science of Food and Agriculture*, November, 1985.

"Food Preservation," *Science Clarified*, http://www.scienceclarified.com/Ex-Ga/Food-Preservation.html#ixzz3PNYxJYzH

Name_____

Food for Keeps

Match the food preservation methods below with the food or foods for which it is used.

1. drying—Extraction of moisture by sun, air, heat or vacuum to inhibit the growth of molds, bacteria and yeasts.
2. salting—the addition of salt or a brine solution to foods to decrease the activity of molds, bacteria and yeasts.
3. fermentation—the use of special bacteria, molds or yeasts to prevent spoilage by converting the elements of food that spoil easily to stable elements that act as preservatives.
4. smoking—the addition of smoke and heat to preserve food by the action of the chemicals from the smoked wood and the partial drying of the food.
5. canning—the packing of food in a container, sealing the container and heating it to sterilize the food.
6. pasteurization—the heating of milk and other liquids which reduces the number of disease-producing bacteria.
7. refrigeration—the lowering of the temperature of food to inhibit the growth of bacteria, molds and yeasts.
8. freezing—the lowering of the temperature of food to temperatures below 28 degrees F to stop the growth of bacteria, yeasts and molds and to kill parasites.
9. freeze-drying—the freezing of food and the subsequent removal of water from the frozen food through the use of heat and a vacuum.
10. food concentration—heating food until it boils and removing the water or partially freezing food and removing water in the form of ice crystals.
11. irradiation—passing energy through food to destroy insects, fungi, or bacteria that cause human disease or cause food to spoil.

___bacon

___beef jerky

___frozen peas

___coffee

___yogurt

___canned fruit

___raisins

___ketchup

___ham

___lettuce

___cheese

___frozen orange juice

___ground beef

___pickles

___milk

Oklahoma Ag in the Classroom is a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education.

Beef Jerky

1. Cut very lean, partially frozen flank steak into thin strips, 1 1/2 to 2 inches wide.
2. Dip the strips in teriyaki sauce.
3. Dry the strips, using one of the following methods:

SUN—DRIED

1. Tie small packages of the strips of meat in cheese cloth and hang them in a sunny window. Keep the packages loose enough so air can circulate around the strips.
2. Every day or so shake the packages gently to make sure they are getting plenty of air.
3. Jerky is ready to eat in about a week, when the meat is shriveled and black and brittle.

OVEN—DRIED

1. Arrange the seasoned strips in a single layer on wire racks. Place a piece of aluminum foil on the bottom of the oven to catch drippings.
2. Preheat the oven to 150 degrees F., and then turn the heat back to 120 degrees F.
3. Place the meat in the oven, leaving the oven door open at the first stop.
4. After five or six hours, turn the strips over.
5. Continue drying at the same temperature for four hours more.
6. Jerky is ready when it is shriveled and black. When cooled, the jerky should be brittle.

MICROWAVE—DRIED

1. Arrange the seasoned strips flat and close together on a microwave—safe bacon rack. cover with waxed paper.
2. Microwave at medium low.
3. Turn the strips over, placing the drier strips in the center of the rack.
4. Rotate the rack 1/2 turn, and continue microwaving at medium low for 21 minutes, until the strips are dry but slightly pliable.
5. Remove to the paper towels.
6. Repeat with remaining strips.
7. Cover the strips with paper towels, and let them stand for 24 hours.

Storage: Wrap the sticks of jerky in plastic wrap, and put them in a container with a tight-fitting lid. Store in the refrigerator or freezer.

Oklahoma Ag in the Classroom is a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education.

Fruit Leather

cookie sheet
plastic wrap
tape
small pieces of fruit—apple, grape, peach, plum, apricot, etc.

1. Line a cookie sheet with a plastic wrap and tape it to the edges. (Do not use wax paper or aluminum foil.)

2. Place small pieces of fruit in a blender. Puree until smooth and thin enough to pour. (Some fruits, like apples and grapes, make a smoother puree if they are cooked with a little water first.)

3. Pour onto the prepared cookie sheet. Tilt pan to spread evently until it is 1/8- to 1/4-inch thick. Leave at least one inch around the edges so the plastic wrap can be removed. Make smaller pieces of fruit leather by pouring puree into small "pancakes."
4. Dry the fruit leather in a warm oven (140 degrees). Leave the door open 2 to 6 inches. Fruit will dry in 4 to 6 hours. If the oven is too hot, it will begin to cook the fruit. If it is too cool, it may not dry fast enough.

5. Dry it until it is still rubbery. The center should not be sticky. Remove the leather from the tray while it is still warm. Peel away the plastic wrap, and roll up the leather.

6. Wrap the leather in plastic or put it in an airtight bag or container.

Oklahoma Ag in the Classroom is a program of the Oklahoma Cooperative Extension Service, the Oklahoma Department of Agriculture, Food and Forestry and the Oklahoma State Department of Education.