



FOOD SAFETY

**A Lesson Plan
developed for
Teachers of Agriculture**

This lesson plan is designed to assist teachers in guiding the learning process in students as they learn more about the importance of food safety. As with any lesson materials that are not prepared by the teacher who uses them, this lesson plan serves only as a guide. Teachers must adapt, supplement, and/or alter this suggested plan according to their expertise and to the local needs, interests, and expected outcomes of the students who are in that classroom. Only in this way will the instruction given meet the needs of the students, school, community, and state in which the students live and the teacher works.

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Lesson Title: Providing Safe Food to the Consumer

Terminal Objective: To identify safe practices to follow in assuring that the food chain from the farm/ranch to table is providing safe and quality food to the consumer

Enabling Objectives: Given a lesson on the safe practices that should be followed in producing, processing, distributing, storing, selling, and preparing food and/or food products, the students will able to:

1. describe the importance of assuring a safe supply of food to the consumer;
2. explain the relationship between bacteria and food safety;
3. describe the four most common foodborne diseases in the U.S.;
4. explain general guidelines that should be followed in the safe handling of all foods;
5. indicate the recommended internal temperatures for cooking different foods;
6. identify potential consequences that may result if food is not handled properly;
7. determine if food is safe;
8. develop a proper response when emergencies related to the safe handling of food occur;
9. identify current issues relating to food safety, and
10. prepare a plan for the safe handling of food for a farm/ranch or in a business.

The teacher is encouraged to add his/her own enabling objectives that would take into account local situations or the need to add additional content information not provided within this lesson outline.

References, Equipment, Instructional Aids, and Selected Web Sites

NOTE: *Teachers should use professional judgment in the selection and use of web sites. Web sites change over time and thus, the relevancy and accuracy of information contained on these sites will change as new information and situations development in the area of food safety.*

Thermometers; cooking, oven, refrigerator/freezer

Petri dishes with agar

Yellow pages of the telephone book

Science and Our Food Supply, Food and Drug Administration and the National Science Teachers Association, no date. Go to the following web site

<http://www.foodsafety.gov/~fsg/teach.html>. A teaching curriculum resource for teachers, including a video, teaching outlines, and laboratory exercises and experiments on food safety.

<http://www.fsis.usda.gov/OA/topics/transportguide.pdf> - Guidelines for the transportation and distribution of meat, poultry, and egg products

http://www.fsis.usda.gov/OA/topics/foodsec_cons.pdf - Highlights what consumers need to know about food safety and food security

www.dh.sa.gov.au/pehs/Food/fsanz-food-hand-skills.pdf - Outlines practices on the safe handling of food

http://www.fsis.usda.gov/News_&_Events/2005_news_releases/index.asp - Current news releases related to food safety issues and developments

http://www.fsis.usda.gov/OA/news/2003/hotline_holiday.htm - A hotline for meat and poultry questions from the consumers. Questions can also be submitted by telephone 1-888-MPHotline (1-888-674-6854) or by e-mail. MPHotline.fsis@usda.gov

<http://www.foodsafety.gov> - A web site with information on food safety

<http://www.cdc.gov/foodsafety> - The Center for Disease Control (CDC) web site focusing on food safety

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/salment_g.htm - CDC web site on Salmonella

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/campylobacter_g.htm - CDC web site on Campylobacter

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/shigellosis_g.htm - CDC web site on Shigellosis

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli_g.htm - CDC web site on E. coli 0157

http://www.fsis.usda.gov/Fsis_Recalls/index.asp - Food Safety and Inspection Service listing of recalled food products

http://www.fsis.usda.gov/Fact_Sheets/keeping_food_Safe_during_an_emergency/index.asp - ABCD's of Keeping Food Safe in an Emergency

<http://www.ready.gov/america/getakit/water.html> and <http://www.ready.gov/america/getakit/food.html> - A suggested water and food kit for an emergency

<http://www.ift.org/cms/?pid=1000379> - Complete report by the Institute of Food Technologists – **Emerging Microbiological Food Safety Issues: Implications for Control in the 21st Century** and frequently asked questions about food safety issues

Lesson Plan Color Code

GREEN – Suggestions to the teacher of teaching approaches, teaching techniques, instructional aids, or other ideas that the teacher might find helpful in teaching this lesson. Space is also adequate for teacher notes.

BLUE – Web sites that provide information, knowledge, or background that relate to the Enabling Objectives for the lesson. In some cases, the teacher can use the web sites to prepare for the lesson, in other cases; the students can go to the web sites for basic information or further reading.

RED – Questions a teacher can pose to the students or they can be used to guide the teaching process. Question numbers relate back to the Enabling Objectives found at the beginning of the lesson.

Introduction: The following ideas are possible suggestions for introducing this lesson topic.

1. With the manager's permission at a local grocery store, take a thermometer and record temperature readings in various coolers and freezers in the store. **What were your findings?**
2. Allow some food products to develop mold on them. **Ask students what may have led to this situation?** For example, store a food product(s) somewhere in the classroom or laboratory in an unsatisfactory condition. Have students observe the daily change in the food structure or characteristics and how long it takes for the food to show signs of spoilage.
3. If a food processing plant is in the school district, take a field trip to observe how food products are processed, pointing out precautions taken to assure a safe and quality product at the end.
4. Ask a food and/or health inspector to visit class and explain his/her job duties, common examples of food safety violations that he/she has encountered, importance of a safe and secure food source for the consumer, and general guidelines that the average person should practice when handling food in any situation.
5. Visit the school cafeteria to learn of the safety precautions that must be followed in the storing, processing, preparing, and serving food at the school. Keep in mind that the school cafeteria serves more meals to people each day than most restaurants in the community.

As a transition to the lesson, the teacher might assign students to look around their homes for situations related to the safe handling and storage of food. For example, check the refrigerator for left over food that may have begun to show signs of spoilage, expiration dates on foods in the refrigerator, pantry, or cupboards, cooking instructions on labels given for different foods, sections of cookbooks that discuss or provide guidelines for the safe cooking or storing food, or taking an oven thermometer and checking to see how close the oven temperature is to the setting on the stove dial.

TEACHING OUTLINE

Methods/hints/aids
Teacher notes

Technical/subject matter content

1a. What impact does foodborne illnesses have on the U.S.?

<http://www.cdc.gov/foodsafety/>

U.S has one of the **safest** food supplies in the world

Compare these numbers with the population of your state, town/city, school

BUT each year

76,000,000 people get sick from foodborne illnesses

300,000 people are hospitalized

5,000 people die

Today there is **five times** the number of dangerous bacteria in our food than we were aware of in 1942

You can become sick in **20 minutes** to **6 weeks** after eating food with harmful bacteria

People especially prone to foodborne illnesses are infants and young children, pregnant women, older adults, and people with weakened immune systems (caused by cancer treatments, AIDS, diabetes, kidney disease, and organ transplants)

1b. What outbreaks of illnesses have occurred in our state?

Teacher assigns students to the web site below to find the outbreaks for their state

<http://www.cdc.gov/foodsafety>

List examples given on the chalkboard

1c. Why be concerned about food safety?

About **50 percent** of the money spent on food goes toward food prepared by others

Have students go to the yellow pages and count the number of these institutions that are in the community and estimate the number of meals served each day

Many people eat meals prepared by hospitals, nursing homes, children day-care centers, and school cafeterias each day

Much of the food today comes from around the **world**, where food sanitation may be lacking

Resistant bacteria are on the **rise**. In 1950, **five** foodborne pathogens were known, in 2002, this number had grown to **25**

2a. What is bacteria (pl) or bacterium(s)?

Single cell **microorganisms**, of which some are **beneficial** to man and others are **harmful**

Bacteria are found **everywhere**

They multiply **rapidly**; one cell can double in 20 minutes. They multiply through binary fission or they divide into two cells every 20-30 minutes.

2b. How many bacteria would exist after 24 hours from a single cell division?

Chalkboard and in student notes, calculate the number of bacteria after 24 hours

Conduct a lab experiment to find bacteria in the classroom. Use Petri dishes with nutrient agar

Bacteria are **small**; **1 million** can fit inside 1 square inch

Bacteria that are harmful to man are called **pathogens**

2c. How can food become contaminated with bad bacteria (pathogens)?

Animals –droppings and saliva or disease microorganisms within the animal. Thus if food is not properly cooked, foodborne illness can occur.

Soil – contaminated animal droppings that are transferred to plants, thus if the plant products are not cleaned or cooked properly, foodborne illness can occur.

Water – contaminated animal droppings come in contact with water, and water is consumed or sprayed on crops

Humans – food contaminated with hands that are not clean

2d. What do bacteria need to grow and reproduce?

Nutrients – bacteria, like people, need many of the same things that humans need to grow

Moisture – bacteria need moisture to grow and reproduce. They may exist on dry food and surfaces, but nothing will happen until moisture is introduced.

pH- bacteria grow well around a 4.6 pH. That is why acidic foods tend to be safe from pathogenic bacteria.

Temperature – bacteria grow rapidly in temperatures between 80-105 degrees F. Proper cooking and chilling slows the growth of bacteria.

Time –bacteria can multiply rapidly, sometimes two to three times per hour

3. What are the more common foodborne illnesses?

<http://www.cdc.gov/foodsafety>

Salmonella

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/salment_g.htm

A bacteria related illness related to contaminated eggs

Symptoms include fever, abdominal cramps, and diarrhea beginning 12 to 72 hours after consuming a contaminated food or beverage

The illness usually lasts 4 to 7 days, and most persons recover without antibiotic treatment. However, the diarrhea can be severe, and the person may be ill enough to require hospitalization

Campylobacter

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/campylobacter_g.htm

An infectious disease caused by bacteria

Symptoms include diarrhea, cramping, abdominal pain, and fever within 2 to 5 days after exposure to the organism. Can be accompanied by nausea and vomiting.

The illness typically lasts 1 week. Some persons who are infected with *Campylobacter* don't have any symptoms at all. In persons with compromised immune systems, *Campylobacter* occasionally spreads to the bloodstream and causes a serious life-threatening infection.

Shigella

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/shigellosis_g.htm

An infectious disease caused by bacteria

Symptoms include diarrhea, fever, and stomach cramps starting a day or two after exposure to the bacterium. The diarrhea is often bloody.

The illness usually resolves in 5 to 7 days and can be severe in children and the elderly resulting in hospitalization.

E. coli 0157:H7

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/escherichiacoli_g.htm

An emerging cause of foodborne illness by bacteria

Symptoms bloody diarrhea, and occasionally kidney failure

The illness has been associated with eating undercooked, contaminated ground beef. Person-to-person contact in families and child care centers is also an important mode of transmission. Infection can also occur after drinking raw milk and after swimming in or drinking sewage-contaminated water.

4. What are some general guidelines for the safe handling of any food?

http://www.fsis.usda.gov/OA/topics/foodsec_cons.pdf

Clean – Wash hands and surfaces often with soap and warm water

Dishes/utensils – Wash cutting boards and equipment after each use and before using on the next food item

Wipe up – Use paper towels for cleaning up surfaces

Separate – Do not cross contaminate foods. This includes separating raw foods from other foods at the grocery store and when placing in refrigerator. Use separate cutting boards for raw meat and other foods. Never place cooked foods on plates that previously held raw food, unless they have been washed properly.

Canned food cleanliness – Always clean can tops before opening

Defrosting – Never defrost at room temperature. Thaw food in refrigerator, under cold running water, or in microwave.

Marinating food – Always marinate food in refrigerator

Cooking – Use food thermometer to be sure meat has been cooked to the proper temperature. Keep hot food at 140 degrees or higher. When reheating leftovers, bring to 165 degrees and sauces and soups should be brought to a rolling boil.

Leftovers – Refrigerate or freeze perishables or prepared food leftovers within 2 hours. The most dangerous temperature zones for foods are between 40-140 degrees F. Thus store below 40 degrees or cook above 140 degrees.

Tasting – Do not taste any food suspected of being spoiled. The tiniest amount of contaminated food can be deadly.

Storage – Do not store foods beyond their expiration date. Canned foods should be stored in a cool, dry place. High-acid foods (tomatoes and some fruit) can be stored up to 18 months; Low-acid foods (meat and vegetables) can be stored 2-5 years.

Have students create a bulletin board on safe handling of food – 4 Cs

Summary on safe handling of food – 4Cs

Clean
Cook
Combat cross contamination
Chill

5. What are the recommended internal cooking temperatures for different foods?

www.dh.sa.gov.au/pehs/Food/fsanz-food-hand-skills.pdf

Ground meat and meat mixtures – degrees F

Beef, pork, veal, lamb	160
Turkey, chicken	165

Fresh beef, veal, lamb

Medium rare	145
Medium	160
Well done	170

Poultry

Chicken and turkey (whole)	180
Poultry breast, roast	170
Poultry thighs, wings	180
Duck and Goose	180
Stuffing	165

Fresh Pork

Medium	160
Well done	170

Ham

Fresh (raw)	160
Pre-cook (to reheat)	140

Eggs and Egg Dishes

Eggs, cook until yolk and white are firm, egg dishes 160

Leftovers and casseroles 165

6. What might happen if food is not handled safely?

Ask students for example
Articles in newspapers

List on chalkboard

People get **sick** – flu like symptoms (fever, vomiting, diarrhea).

Food that is contaminated is **wasted** and results in **lost money**

Lost work/wages for employee

Lost, reduced, or disrupted production for employers

Companies/restaurants can be **sued**

Companies/restaurants can be **closed** (temporarily or permanently) or go **bankrupt**

Some illnesses are **contagious**, thus they can spread

Ask students to describe
situations they have observed
where food did not appear
safe

7. How can a person tell if food is safe?

Do not use food products that are **discolored**

Be cautious of any food that comes through the **mail**

While **color** may be an indication if food is cooked properly, it is **not** a recommended test

Never buy foods where the package is **opened, damaged, seals are broken, cans are punctured or dented**

Never use food from cans that are **leaking, bulging, rusting**, or from jars that are **cracked** or with **loose lids**

Inspect all foods with a date. Do not eat any food for which the **expiration date** has **passed**.

If consumers are unsure of the safety of any food, whether it is related to product tampering, quality and safety, or resulting illness from eating suspect food, they should call the **USDA Meat and Poultry Hotline – 1-888-MPHotline (1-888-674-6854)**. For non-meat and poultry products, call the **Food and Drug Administration 1-888-SAFE-FOOD (1-888-723-3366)**

If **tampering** is suspected, **preserve** the evidence, plus the package and store receipts. **Contact the local law enforcement officials** or the call **the toll free numbers** listed earlier.

8. What are some general guidelines to follow to keep food safe in an emergency?

http://www.fsis.usda.gov/OA/topics/foodsec_cons.pdf htm

http://www.fsis.usda.gov/Fact_Sheets/keeping_food_Safe_during_an_emergency/index.asp

During power failure

Freezer door, keep **closed** as much as possible. A full freezer will be okay for two days, half-full freezer, one day.

If power will be out more than two days, use dry ice. Partially thawed food can be refrozen if still below 40 degrees F.

Refrigerator door, keep **closed** as much as possible. Items will stay cool up to four hours. Items above 40 degrees for two hours or more should be discarded.

<http://www.ready.gov/america/getakit/water.html>
<http://www.ready.gov/america/getakit/food.html>

Supplies for an emergency

Three day supply of nonperishable food.
Suggestions are: dried fruit; canned fruit and vegetables; shelf-stable small cans of meat, poultry, and fish; jars of peanut butter and jelly; small packages of cereal, granola bars, and crackers; nonfat dry milk; and small boxes of juice drinks.

Remember to include **infant formula, pet food,** and foods for family members with **special dietary needs**

Three day supply of bottled water (three gallons per person)

Manually operated **can opener**

Flashlight

Battery operated radio

Product recall

http://www.fsis.usda.gov/Fsis_Recalls/index.asp

Teacher assigns students to check this site for foods currently on the recall list

Food Safety and Inspection service notifies public through the news media when products added to the recall list

Students report back to class

Suspect food served to large groups, or illness has occurred to a number of people at a large gathering

Contact your local health department

Student look up telephone number

9. What are the current issues related to food safety?

Teacher selects which one(s) to discuss

<http://www.ift.org/cms/?pid=1000379>

Discussion on the issues

Globalization of the food supply – Imported and exported foods will only increase in the future. **How can the regulatory agencies handle this increased activity? How can countries work together to protect and provide a safe food supply that is traded between countries?**

Alternative processing technologies and novel foods – With each new introduction, possible consequences, some intended and some unintended, will occur. **How quickly can these new technologies and foods be studied to determine their safety?**

Increase use of organic foods – Production and the demand for organic foods will continue to grow. The general impression is that organic foods are safer, but that is not always true. **How can producers of organic foods minimize the possibility of pathogens contaminating their foods and what precautions should consumers take with organic foods?**

Changes in food consumption – Increase in ethnic food demands and consumers eating more fruits and vegetables pose problems. Raw and fresh vegetables and fruits (that are eaten uncooked) have a greater chance for dangerous pathogens to be consumed by the public. **How can the public be educated on the safe practices for eating fruits and vegetables?**

At-risk subpopulations – As the numbers of elderly population grows, a group more susceptible to foodborne illnesses, and the technology for organ transplants develops further. **How should people and businesses**

directly involved in the food chain change their practices?

Pathogen evolution –Microbial evolution has always and will always occur, meaning that health and regulatory agencies must continue to monitor the food supply chain to assure safe foods. **How will society pay for this continual expense?**

Consumer understanding – All participants in the food supply chain must accept the responsibilities and risks that are associated with safe foods. **How can young children be educated on the safe practices for the safe handling of foods? How can adults be reminded of their responsibilities?**

Integrated food supply –The farm/ranch to table food supply and safety system is a complex system and involves many different environments, people, and businesses. **What role and responsibility can each of you assume in this system to help assure safe food for yourself and others?**

Cooking and refrigerating foods – Consumers cannot be misled that proper cooking and refrigeration destroys all pathogens. **Thus, what are the recommendations for safe cooking and refrigeration?**

Identifying all foodborne pathogens – The number of diseases caused by pathogens is more than 200 and it is still growing. **How can society keep ahead of these new evolutions?**

Controlling the worst pathogens –It is difficult to determine the worst pathogen. **Should researchers focus on a pathogen that affects a low number of people, but is deadly, or on one that affects a large number of people, but is not deadly?**

10. What would be the essential elements of a food safety plan, taking the food from the producer to the consumer in a safe procedure?

NOTE: If the teacher desires to teach the content associated with Question 10, then the student should be referred to the web site below for more details and information related to a safe transportation and distribution system. The major parts of a food safety program are highlighted in the content section of this lesson.

<http://www.fsis.usda.gov/OA/topics/transportguide.pdf>

Develop an overall **transportation safety plan**, addressing the need to handle and maintain food in a manner not to compromise the quality, and a security plan to protect the food against tampering or damage

Require a program to **train** and to **educate** employees, or hire **qualified** employees for the tasks to be performed

Provide a **safe** and **secure** food **storage** system

Arrange for a **monitoring system** for stored food products

Assure that **vehicles transporting** food products are designed for that task. Keep in mind that food products could be transported by car, truck, train, airplane, boat.

Assure that **pre-loading** environments follow recommended conditions

Assure that **loaded** food products are **protected** and recommended conditions can be **maintained**

Arrange for **in-transit checks** of food conditions

Assure that **unloading environments** follow recommended conditions

If food products **cross country boundaries**, special rules and regulations could apply. (It is estimated that of the internationally shipped food, **60 percent goes by sea, 35 percent by land, and 5 percent by air**)

Summary

This unit includes much information about a safe and secure food supply.

1. Daily summaries at the end of the class are encouraged and/or quizzes could be used.
2. Teachers should refer to the enabling objectives at the beginning of the lesson unit and/or the questions highlighted throughout the lesson for ideas of summaries.

Plans for Application

This unit has multiple opportunities for students to apply the content covered. The following is only a partial list.

1. Preparing a speech on the importance of food safety, any of the pathogens, or guidelines for the safe handling of food.
2. Checking the web site for outbreaks of illnesses in the state.
3. Developing a checklist for observing safe handling of food at home, then share it with his/her parents.
4. Conducting an experiment on finding bacteria.
5. For those working in restaurants, talk with the manager about the companies' guidelines for the safe handling of food, observe and practice safe food habits, talk with other employees about safe food handling.
6. Cook or help cook a meal at home, taking special responsibility for checking the recommended cooking temperatures and times.
7. Prepare a food safety kit for the home in the case of emergencies.
8. Visit a local food processing company, grocery store, restaurant, transportation company that hauls food products, or producers and talk with employees about safe and secure food.

Evaluation

1. Cognitive tests could be developed relating to the information presented.
2. Experiments could be conducted: Refer to the **Science and Food Supply** materials or web site, <http://www.foodsafety.gov/~fsg/teach.html>.
3. Students could be assigned to develop a guide or checklist on safe and secure food practices for where they work or live, incorporating the 4 Cs.
4. Students could be observed in the safe application of practices at FFA Chapter events involving food.