Teacher’s Guide to Food & Foodborne Illness

Food Safety & Foodborne Illness

What is Food Safety?
Food Safety is making a food safe to eat and free of disease causing agents such as:
- Too many infectious agents
- Toxic chemicals
- Foreign objects

What is Food Quality?
Food Quality is making a food desirable to eat with regards to good taste, color, and texture; bad food quality can be judged by:
- Bad color
- Wrong texture
- Smells bad
- Temperature

What are the Types of Food Hazards?
- Biological: bacteria, viruses, parasites
- Chemical: heavy metals, natural toxins, sanitizers, pesticides, antibiotics
- Physical: bone, rocks, metal

Examples of Biological Food Hazards
- Biological = living organisms
- In Meat and Poultry:
  - Salmonella bacteria (poultry and eggs)
  - E. coli bacteria (beef and ground beef)
  - Trichinella spiralis parasite (pork)
- On Fruits and Vegetables:
  - Salmonella bacteria (bean sprouts)
  - E. coli bacteria (apple juice)
  - Cyclospora parasite (raspberries)
  - Hepatitis A virus (strawberries)

How can you prevent Biological Hazard to Foods
- Prevention of microbes growing
  - Holding at low temperatures (<40°F)
  - Cooling from 140°F-40°F quickly
  - Cooking helps to kill microbes
    - >165°F(73°C) for poultry and eggs
    - >155°F (68°C) for ground beef
    - >160°F (71°C) for pork

Examples of Chemical Hazards in Food
- Chemical hazard: a toxic substance that is produced naturally added intentionally or un-intentionally
  - Naturally-occurring: toxic substances produced by other living organisms
Added intentionally: nitrates in meat, pesticide residues in feed
Added non-intentionally: any unwanted substance (cleaning agents)
  o In Meat and Poultry
    ▪ Nitrate agents (red meat)
    ▪ Aflatoxins, pesticides (feed)
    ▪ Nutritional Supplements, i.e. hormones (livestock)
    ▪ Antibiotics (poultry)
    ▪ Cleaners, sanitizing agents (meat and poultry)

Examples of Physical Hazards in Food

- Physical hazard: a hard foreign object that can cause illness or injury
  o Inherent to the food or ingredient
  o Contaminant during processing
- In the food or ingredients
  o Bone fragments (ground beef)
  o Feathers from animal carcass (turkey)
- Contamination during processing
  o Stones, rocks, dirt in vegetables
  o Metal from processing equipment (ground beef)
  o Jewelry, fingernails (food handler)

What is a Foodborne Illness?

- Definition of Foodborne Illness: Foodborne illnesses are defined as diseases, usually either infectious or toxic in nature, caused by agents that enter the body through the ingestion of food.
  o Every person is at risk of foodborne illness.
  o No long-term health threat to average person
  o May be serious for very young, very old, people with long term illness
  o Reaction may occur in a few hours or up to several days after exposure

- Symptoms - could be abdominal cramps, headache, vomiting, diarrhea (may be bloody), fever, death

What is the impact of Foodborne Illness?

- Foodborne diseases are a widespread and growing public health problem, both in developed and developing countries.
- The global incidence of foodborne disease is difficult to estimate, but it has been reported that in 2000 alone, 2.1 million people died from diarrheal diseases. A great proportion of these cases can be attributed to contamination of food and drinking water. Additionally, diarrhea is a major cause of malnutrition in infants and young children.
- In industrialized countries, the percentage of people suffering from foodborne diseases each year has been reported to be up to 30%. In the United States of America (USA), for example, around 76 million cases of foodborne diseases, resulting in 325,000 hospitalizations and 5,000 deaths, are estimated to occur each year.
- While less well documented, developing countries bear the brunt of the problem due to the presence of a wide range of foodborne diseases, including those caused by parasites. The high prevalence of diarrheal diseases in many developing countries suggests major underlying food safety problems.
While most foodborne diseases are sporadic and often not reported, foodborne disease outbreaks may take on massive proportions. For example, in 1994, an outbreak of salmonellosis due to contaminated ice cream occurred in the USA, affecting an estimated 224,000 persons. In 1988, an outbreak of hepatitis A, resulting from the consumption of contaminated clams, affected some 300,000 individuals in China.

**Why is Foodborne Illness increasing in the US?**
- Each year in the United States, an estimated 76 million persons contract foodborne illnesses (Centers for Disease Control (CDC))
- Preference for “rare” meats
- Use of immunity suppressant medications & conditions (HIV/AIDS)
- Increase in the number of elderly
- Increase shelf life of products which allow for bacterial growth
- Centralized food production
- Increase consumption of imported ready-to-eat foods

**What are the most commonly reported Foodborne Illnesses in the US?**
- The most commonly reported are biological foodborne illnesses
- Campylobacter: 20 cases per 100,000 population; estimated 2.4 million persons/yr
- Salmonella: An estimated 1.4 million cases occur annually in US
- Shigella: Approximately 14,000 laboratory confirmed cases; estimated 448,240 total cases/yr
- E Coli 0157: An estimated 73,000 cases/yr
- Cryptosporidium: 0.2-0.9 cases/100,000 in the general population; persons with AIDS, annual incidence is 2-4 cases/1000
- Listeria: Approximately 2500 cases/yr
- Vibrio: Average 30 culture-confirmed cases, 10-20 hospitalizations, and 1-3 deaths from the Gulf Coast region; nationwide 3000 cases/yr

**What is Hazard Analysis Critical Control Point (HACCP)?**
The purpose of HACCP is to help ensure the production of safe food
- The goal of HACCP is to prevent and/or minimize risks associated with biological, chemical, and physical hazards... to acceptable levels
- It is based on PREVENTION rather than detection of hazards
  - Pioneered in the 1960’s: first used for the space program (Pillsbury & NASA)
- Cleaning = chemical or physical process of removing dirt or soil from surfaces.
  - Cleaning removes 90-99% of bacteria, but thousands of bacteria may still be present
- Sanitizing = process that results in reduction/destruction of microbes
  - Chlorine, iodophors, and quaternary ammonia compounds most common.

**What are the steps involved in HACCP?**
1. Identify hazards
2. Determine Critical Control Points (CCPs)
3. Determine safety limits for CCPs
4. Monitor CCPs
5. Corrective action  
6. Record data  
7. Verify that the system is working

- Example: A “farm-to-the-fork approach”: Control points
  - On-farm agriculture  
  - Transportation  
  - Food preparation & handling  
  - Food processing
    - Meat and poultry regulations  
    - Seafood regulations  
  - Food service  
  - Consumer handling & use

**Examples of Food Safety Facts & Questions (FAQ’s)**

- **Question: If soap is unavailable, is there any value in washing your hands without it?**
  
  Answer: Yes, the friction of rubbing your hands together under running water removes dirt and contaminants.

- **Question: What does “life begins after 40” mean?**
  
  Answer: Relating to food safety temperatures, it means that bacteria multiply faster between 40° - 140° F (4° - 60° C) and the amount of bacteria may cause foodborne illness.

- **Question: Are gloves recommended to avoid cross contamination of foods in your kitchen?**
  
  Answer: Actually, gloves only separate your hands from food. The surface of the gloves may become contaminated with bacteria or meat juices and spread to other foods and surfaces. Wearing gloves may also give a false sense of security or lead to people not realizing how often they need to change them.

- **Question: Does the rule mean you can keep food out 2 hours after eating?**
  
  Answer: No. The two hour rule means that you return food to refrigerator or freezer within 2 hours of removing it from the refrigerator or oven. This includes the length of time that the meal lasted.

- **Question: What does the “Expiration Date” mean?**
  
  “Expiration” means do not sell or use after date listed. “Sell by” means that you should buy the product before the date expires. “Best if used by” means that the flavor quality is at its best before the date listed. “Use by” means that is the last day that quality can be guaranteed. It is a good idea to consume that product prior to that date.

- **Question: Why not defrost frozen food on the countertop?**
  
  Answer: When foods are defrosted at room temperature, the actual temperature of the food may reach temperatures above 40 degrees. Portions of the food to be defrosted may be in fact be a perfect breeding environment for bacteria, while other portions remain colder. Therefore, defrosting is best done in the refrigerator.
Food & Nutrition

What are Calories?
- Calories are a measure of the amount of energy provided from food
  - Fats provide 9 calories per gram
  - Carbohydrates provide 4 calories per gram
  - Proteins provide 4 calories per gram
  - Alcohol provides 7 calories per gram
- Individuals have different calorie needs based on:
  - Gender
  - Size
  - Age
  - Physical Activity
  - Condition (i.e., pregnancy, lactating)
- Calorie balance occurs when Calories IN = Calories OUT
  - If IN > OUT = Weight gain occurs
  - If IN < OUT = Weight loss occurs
- There are approximately 3,500 calories in one pound of body fat
  - An individual's calorie needs are a combination of their calorie needs for:
    - Basal metabolism (50-60% of calorie needs)
    - Physical activity (30-40% of calorie needs)
    - Digestion and metabolism of food (10% of calorie needs)

What are Fats?
- Definition: Fats are organic compounds that are made up of carbon, hydrogen, and oxygen; they are the most concentrated source of energy in foods. Fats belong to a group of substances called lipids. Fats come in liquid or solid form. All fats are combinations of saturated and unsaturated fatty acids. Fats can be called very saturated or very unsaturated depending on their proportions.
- Function: Fat is one of the three nutrients (along with protein and carbohydrates) that supply calories to the body. Fat provides 9 Calories per gram, more than twice the number provided by carbohydrates or protein.
- Part of cell membranes and component of many body compounds.
  - Body fat protects internal organs and provides insulation from heat loss.
  - Source of fat-soluble vitamins and essential fatty acids.
  - Concentrated source of stored energy.
- Fats are broken down to fatty acids and glycerol
  - Fatty acids can be divided into three groups:
    - Saturated fatty acids.
    - Monounsaturated fatty acids.
    - Polyunsaturated fatty acids.
- Although fat is important, high-fat diets are a risk factor for heart disease, cancer, and obesity.

What is Cholesterol?
- The body needs cholesterol every day.
- Cholesterol serves as the starting material for many important body compounds.
  - Bile acids
• The liver makes cholesterol
  o The liver makes 800 to 1500 mg of cholesterol every day, much more cholesterol than in food.
  o In healthy people the body makes less cholesterol if dietary intake is high, and it makes more cholesterol if dietary intake is low.
  o Dietary saturated fat intake effects cholesterol synthesis more than dietary cholesterol

**What are Carbohydrates?**

- **Definition:** A large group of sugars, starches, celluloses, and gums that contain carbon, hydrogen, and oxygen in similar proportions.

- **Function:** The primary function of carbohydrates is to provide energy for the body, especially the brain and the nervous system. The body breaks down starches and sugars into a substance called glucose, which is used for energy by the body.

- There are three basic types of carbohydrates:
  o Monosaccharides
  o Disaccharides (simple sugars)
  o Polysaccharides (complex carbohydrates)

- Carbohydrates provide 4 calories per gram.
- Glucose is the main carbohydrate the body uses for energy.
- The brain and nervous system can only use glucose for energy.
- Carbohydrates should provide 50 to 60% of total calories.
- 50 to 100 grams of carbohydrate are needed to spare proteins and prevent ketoacidosis.

**What are Proteins?**

- **Definition:** Proteins are complex organic compounds. The basic structure of protein is a chain of amino acids that contain carbon, hydrogen, oxygen, and nitrogen. The presence of nitrogen differentiates protein from carbohydrate and fat.

- **Function:** Protein is the main component of muscles, organs, and glands. Every living cell and all body fluids, except bile and urine, contain protein. The cells of muscles, tendons, and ligaments are maintained with protein. Children and adolescents require protein for growth and development.

- Building Materials
- Enzymes
  o Smaller proteins that catalyze (speed up) chemical reactions.
- Some hormones
  o Messengers turning on and off body processes.
  o Insulin, thyroid hormones, histamine, adrenaline, serotonin.
- Carriers or transporters
  o Nutrients across cell membranes, nutrients in blood, oxygen in blood.
• Fluid and electrolyte balance.
• Antibodies
  o Proteins that function to defend the body.

**Is Water important for good Nutrition?**
• Water is vital for life
• Water is more critical to life than food.
• About 60% of an adult’s body weight and even more of a child’s body weight is water.
• Water is in every cell of the body.
• All chemical processes that occur in the body require water.
  o digestion
  o absorption
  o circulation
  o excretion
  o transporting nutrients
  o building tissues
  o maintaining blood volume
  o maintaining body temperature

**What is the Food Pyramid?**
• The Food Guide Pyramid can help ensure that you get a variety of foods and the nutrients you need. The number of servings you need from each of the different food groups depends on your age, gender, size, and how active you are.
• The original "Four Food Groups" has been replaced with the "Food Guide Pyramid". This illustrates the relative proportions of different foods that make up a nutritious, well-balanced diet.
What is a Serving Size?

- Watching your serving size is still important. Just because something is "reduced fat" or "lighter" in calories, does not mean that you can eat more of it.
- Choosing foods lower in saturated fat and cholesterol will help you to lower your blood cholesterol. By eating a larger portion of a food low in saturated fat, you may eat more or just as much saturated fat and fat as the regular variety.

What are Food Labels?

- "Free" Labels
  - These claims are used to indicate very small amounts of fat, saturated fat, cholesterol, sodium, sugar, and calories.
  - **Cholesterol, sodium, sugar Free** This claim means that a food contains no amount (or a very small amount) of the these nutrients
  - **Calorie-free** means fewer than 5 calories per serving.
  - **Fat-free** means less than 0.5 grams of fat per serving.

- "Low"
  - This claim can be used on all foods that can be eaten often without going over the limit for one or more of these nutrients: saturated fat, cholesterol, fat, sodium, and calories.
  - **Low-saturated fat**: 1 gram or less per serving.
  - **Low-fat**: 3 grams or less per serving.
  - **Low-cholesterol**: 20 milligrams or less and 2 grams or less saturated fat per serving.
  - **Low-sodium**: 140 milligrams or less per serving.
  - **Low calorie**: 40 calories or less per serving.
  - Other words that mean "low," include: "little," "few," and "low source of."
The nutrition information format has been redesigned to help consumers make healthier choices when buying packaged foods. Fresh or raw foods will not have to be labeled as long as retailers voluntarily display nutritional information for the top selling fruits, vegetables and meats at the point of purchase.

1. **The new heading Nutrition Facts** signals that the label contains the newly required information.

2. **Serving sizes** are no longer determined at the manufacturer’s discretion. They are based on surveys of what people actually eat in 139 different product categories. For example, in the past 30 grams of a bag of cookies may have been considered a single serving. Now a serving would be two.

3. **Calories from fat** are now shown to help consumers meet dietary guidelines that recommend we get no more than 30 percent of our calories from fat each day.

4. **The % Daily Value** shows how much of each nutrient a food provides compared with how much of that nutrient is needed each day. These calculations are based on a 2,000-calorie diet. People who consume more or less have to figure out the percentages themselves. A serving of this sample product contains 5 percent of the daily value for fat. The FDA suggests you look for 5 percent or less of fat, cholesterol and sodium in any individual food.

5. **The list of nutrients** covers those most important to the health of today’s consumers, who need to be concerned about getting too much of certain nutrients (like fat) and too little of other nutrients (such as selected vitamins and minerals) that the old labels emphasized. Nevertheless, manufacturers must list vitamins A and C, calcium and iron. They may also include any other nutrients they feel are important.

6. **Daily Values (DV)**, replace the old U.S. Recommended Daily Allowances (U.S. RDA’s). They also set official recommendations for total fat, saturated fat, cholesterol, sodium, carbohydrate and fiber. DVs are based on a 2,000-calorie daily diet.

**How important are Eating Disorders?**

- In US, *conservative estimates* indicate that after puberty, 5-10% of girls and women (that translates to **5-10 MILLION girls and women**) and **1 MILLION** boys...
and men are struggling with eating disorders including anorexia, bulimia, binge eating disorder, or borderline conditions (Crowther 1995).

- At least **50,000** individuals will die as a direct result of their eating disorder.
- Because of the secretiveness and shame associated with eating disorders, many cases are probably not reported. In addition, many individuals struggle with body dissatisfaction and sub-clinical eating disorder attitudes and behaviors. For example, **80%** of American women are dissatisfied with their appearance (Smolak, 1996).
  - **42%** of 1st-3rd grade girls want to be thinner (Collins, 1991).
  - **81%** of 10 year olds are afraid of being fat (Mellin 1991).
  - The average American woman is **5'4"** tall and weighs 140 pounds. The average American model is **5'11"** tall and weighs **117** pounds. Most fashion models are thinner than **98%** of American women (Smolak, 1996).

**What are Anorexia nervosa and bulimia?**

- These disorders generally afflict women—particularly in adolescence and young adulthood—and are much less common among men.
- Some researchers believe that anorexia and bulimia are caused by chemical imbalances in the brain; one study has linked bulimia to deprivation of tryptophan, an amino acid used by the body to make the neurotransmitter serotonin.
- Others contend that these disorders are rooted in societal ideals that value slenderness.

**What is Anorexia nervosa?**

- Refusal to maintain body weight at or above a minimally normal level weight for height, body type, age, and activity level
- Intense fear of weight gain or being "fat"
- Feeling "fat" or overweight despite dramatic weight loss
- Loss of menstrual periods
- Extreme concern with body weight and shape

**What is Bulimia?**

- Characterized by massive food binges followed by self-induced vomiting or use of diuretics and laxatives to avoid weight gain
- Some anorexic patients combine bulimic purges with their starvation routine
- Repeated episodes of bingeing and purging
- Feeling out of control during a binge and eating beyond the point of comfortable fullness

**What is Compulsive overeating?**

- Characterized primarily by periods of uncontrolled, impulsive, or continuous eating beyond the point of feeling comfortably full
While there is no purging, there may be sporadic fasts or repetitive diets and often feeling of shame or self-hatred after a binge

People who overeat compulsively may struggle with anxiety, depression, and loneliness which can contribute to unhealthy episodes of binge eating

Body weight may vary from normal to mild, moderate, or severe obesity

**What is Obesity?**

*Obesity* is defined as an excessively high amount of body fat or adipose tissue in relation to lean body mass. The amount of body fat (or adiposity) includes concern for both the distribution of fat throughout the body and the size of the adipose tissue deposits. Body fat distribution can be estimated by skinfold measures, by waist-to-hip circumference ratios, or by techniques such as ultrasound, computed tomography, or magnetic resonance imaging.

*Overweight* refers to increased body weight in relation to height, when compared to some standard of acceptable or desirable weights. Overweight may or may not be due to increases in body fat. For example, professional athletes may be very lean and muscular, with very little body fat, yet they may weigh more than others their same height simply because of their larger muscle mass. While they may qualify as "overweight," they are not necessarily "over fat."

More recently, **Body Mass Index (BMI)**, has been used to determine obesity. BMI is a measure expressing the relationship (or ratio) of weight-to-height. BMI is a mathematical formula in which a person's body weight in kilograms is divided by the square of his or her height in meters (i.e., wt/(ht)²). The BMI is more highly correlated with body fat than any other indicator of height and weight.

Individuals with a BMI of 25 to 29.9 are considered *overweight*, while individuals with a BMI of 30 or more are considered *obese*.

**What Are The Consequences Of Obesity?**

Many medical, psychological, social and economic conditions are associated with obesity.

Medical conditions include:
- High Blood Pressure
- Heart Disease
- Diabetes
- Osteoarthritis
- Shortness of Breath
- Sleep Apnea
- Gallbladder Disease
- Gastrointestinal Disorders such as heart burn and reflux
- High cholesterol and triglyceride levels
- Menstrual irregularities
- Urinary Incontinence
- Certain Cancers
Psychological conditions include:
- Depression
- Low Self Esteem
- Social Withdrawal

Social conditions include:
- Difficulty finding attractive clothing
- Poor hygiene and sanitation
- Difficulty going to a movie, sitting on an airplane or going through a turnstile
- Difficulty walking or climbing stairs
- Sexual limitations

Economic conditions include:
- Cost of weight loss programs
- Health care costs for comorbid conditions
- Difficulty obtaining insurance coverage
- Job discrimination for placement or promotion

What is the prevalence of obesity in the US?
- 61% of adults in the United States were overweight or obese (BMI > 25)* in 1999.
- 13% of children aged 6 to 11 years and 14% of adolescents aged 12 to 19 years were overweight in 1999. This prevalence has nearly tripled for adolescents in the past 2 decades.
- The increases in overweight and obesity cut across all ages, racial and ethnic groups, and both genders.
- 300,000 deaths each year in the United States are associated with obesity.
- The economic cost of obesity in the United States was about $117 billion in 2000.