PRINCIPLES OF FOOD SANITATION, SAFETY & HYGIENE

A lecture compilation

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Introduction:

Food sanitation is more than just cleanliness. It included all practices involved in protecting food from risk of contamination, harmful bacteria, poisons and foreign bodies, preventing any bacteria from multiplying to an extent which would result in an illness of consumers; and destroying any harmful bacteria in the food by thorough cooking or processing.

The primary tenet of food-service sanitation is absolute cleanliness. It begins with personal hygiene, the safe handling of foods during preparation, and clean utensils, equipment, appliances, storage facilities, kitchen and dining room.

Control of the microbial quality of food must focus on the preparation of food itself, food handlers, facilities and equipment. The quality of food depends on the condition when purchased and the time temperature control during storage, preparation and service. Personal hygiene and cleanliness of the facilities and equipment also contribute to food safety.

CHAPTER 1

• Definition of terms
  1. **Food** – Any substance whether simple, mixed or compounded that is used as

   food, drink, confectionery or condiments.
  2. **Safety** – is overall quality of food fit for consumption.
  3. **Sanitation** – is a health of being clean and conducive to health.
  4. **Cleanliness** – is the absence of visible soil or dirt and is not necessarily sanitized.
  5. **Microbiology** - the branch of biology that deals with microorganisms and their effect on other microorganisms.
  6. **Microorganisms** - organism of microscopic or submicroscopic size. (bacterium , protozoan).
  7. **Food Infection** - microbial infection resulting from ingestion of contaminated foods.
  8. **Food Intoxication** - type of illness caused by toxins. Under favorable condition certain bacteria produce chemical compounds called toxins.
  9. **Food Spoilage** - means the original nutritional value, texture, flavor of the food are damaged, the food become harmful to people and unsuitable to eat.
  10. **Foodborne Illness** – A disease carried or transmitted to people by food.
11. Foodborne Outbreak – An incident in which two or more people experience the same illness after eating the same food.
12. Contamination – The presence of harmful substances in the food
13. Time-Temperature Abuse – Food that has been exposed to temperature favorable to the growth of foodborne microorganisms.
14. Potentially Hazardous Foods – Food in which microorganisms can grow rapidly. It is often moist, high protein, slightly acidic.
15. Cross Contamination – Occurs when microorganisms are transferred from one surface or food to another
16. Personal Hygiene – Sanitary health habits that include keeping the body, hair, teeth, clothes and washing hands regularly.
17. Temperature Danger Zone – temperature range (41°F -140°F) food borne bacteria grow and reproduce

- Food Safety : A Top Priority

Food safety is the responsibility in every person who is involved in food service. Serving safe food is the top priority for every food service employee.

1. Dangers of food borne illness

a. Individual – Food borne illness are the greatest danger to food safety. It could result to illness or diseases to an individual that would affect their overall health, work and personal lives.
   - Loss of family income
   - Increased insurance
   - Medical expenses
   - Cost of special dietary needs
   - Loss of productivity, leisure and travel opportunities
   - Death or funeral expense

b. Establishment – Food borne illness outbreak can cost an establishment thousands of pesos, it can even be the reason an establishment is forced to closed.
   - Loss of customers and sales
   - Loss of prestige and reputation
   - Lawsuits
   - Increase insurance premiums
   - Lowered employee morale
   - Employee absenteeism
   - Increase employee turn over
   - Embarrassment
2. **Types of Food Contaminants**
   
a) Biological Contaminants  
b) Physical Contaminants  
c) Chemical Contaminant  

A. **Biological Contaminant** – A microbial contaminant that may cause a food borne illness (bacteria, viruses, fungi, parasites, biological toxins)  
   Examples:  
   - Sea food toxins  
   - Mushroom toxins  
   - Clostridium Botulinum  
   - Salmonella bacteria  

   **COOKING DOES NOT DESTROY TOXINS**

   **Preventing Biological contaminant:**  
   - Purchase foods only on reputable supplier  
   - Do not use wild mushrooms  
   - Maintain good personal hygiene  
   - Observe proper hand washing  
   - Clean and sanitize equipment  
   - Maintain clean and sanitize facilities  
   - Control pests

B. **Physical Contaminant** – any foreign object that accidentally find its way into food  
   Examples:  
   - Hair  
   - Staple wire  
   - Dust

   **Preventing Physical Contaminants:**  
   - Wear hair restraint  
   - Avoid wearing jewelry when preparing, cooking and holding foods (ring, earrings)  
   - Do not carry pencil or pen  
   - Do not wear nail polish or artificial nails when working with foods  
   - Clean can openers regularly  
   - Remove staple wire in the receiving area  
   - Place shields on lights
C. **Chemical Contaminant** – a chemical substance that can cause food borne illness.
Substances normally found in restaurant
Examples:
Toxic metals
Pesticides
Cleaning product
Sanitizers
Preservatives

**Preventing Chemical Contaminants:**
- Teach employees how to use chemicals
- Store chemicals in original containers to prevent accidental misuse, as well as leakage into food
- Make sure labels are clearly identify chemical contents of chemical containers
- Always chemical according to chemical recommendation
- Always test sanitizing solution
- Wash hands thoroughly after working with chemicals
- Wash foods in cold running water
- Monitor pest control operator and make sure chemicals do not contaminate foods

Utensils and equipment containing potentially toxic metals:
1. Lead
2. Copper
3. Brass
4. Zinc
5. Antimony
6. Cadmium

Highly acidic foods such as tomatoes or lemons can react with metals

3. **(3) Main Causes of Food Borne Illness**

1. Cross- Contamination
2. Time-Temperature Abuse
3. Poor Personal Hygiene
Cross Contamination  - occurs when microorganisms are transferred from one surface or food to another. The bacteria can transfer from:

1) Hand to food Contamination - Occurs when contaminated hands handle cooked or ready to eat foods.

How to prevent hand to food contamination?
- Wash hands properly
- Cover cuts, sores and wounds
- Keep fingernails short, unpolished & clean
- Avoid wearing jewelry, except for plain ring

When to wash hands?
Before:
1) Beginning food preparation
2) Putting on disposable gloves
3) Serving customers
After:
1) Arriving at work and after break
2) Using the restroom, washing sinks
3) Eating, drinking, smoking, chewing tobacco and gums
4) Using the telephone
5) Using handkerchief or tissue
6) Handling inventory
7) Handling raw foods
8) Touching or scratching a part of the body
9) Coughing, sneezing
10) Handling garbage
11) Touching dirty surfaces

How to Wash Hands?
1) Use the hand washing sink with running at approximately 100°F and liquid soap.
2) Lather hands and exposed arms
3) Rub hands for at least 20 seconds
4) Wash hands thoroughly, paying attention to fingernails
5) Rinse in clean running water. Turn off the faucet with paper towel in your hands
6) Dry hands using paper towel or air dryer. Not cloth or apron

2) Food to Food Contamination - When harmful organisms from one food contaminate other foods. (raw meats, thawing meat on top of the shelf where it can drip on the other foods)
How to prevent Food-Food Contamination

- Store cooked foods that will not be cooked in the refrigerator on a higher shelf than raw foods.
- Best to practice mix left over foods with fresh foods
- Wash fruits & veg, in a cold running water
- Do not let raw meat and raw vegetables be prepared on the same surface at the same time

3) Equipment to Food Contamination

How to prevent:
- Use separate cutting boards for different foods (meat- veg)
- Prepare raw foods in separate area from fresh and ready to eat foods
- Clean & sanitize equipment, work surfaces & utensils after preparing each foods
- Use specific containers for various food products.
- Make sure cloth and paper towel use for wiping spills are not used for any other purposes

TIME TEMPERATURE ABUSE – happens when the food is exposed to Temperature Danger Zone (41°F - 140°F) for more than 4 hrs.

Time Temperature Abuse occur when:
- Food is not stored, prepared or held at a required temperature
- Food is not cooked or reheated to temperature high enough to kill harmful microorganisms
- Food is not cooled low enough fast
- Food is prepared in advance and not set to a safe required internal temperature while the food is on hold

Preventing Time Temp. Abuse
- Never expose the food to Temperature danger zone: 41°F - 140°F
  Not to exceed 4 hours, except cool-down
- Document temperatures & time
- Includes receiving, storage, preparation, holding, serving, cooling, and reheating
- Pass food through danger zone quickly

Keep hot foods hot. Keep cold foods cold
Don’t keep the food at all
Internal temperature should be 140°F to prevent harmful microbes from growing
POOR PERSONAL HYGIENE – Food handlers are carriers of disease causing bacteria. Food service personnel can contaminate food.

Basics of Good Personal Hygiene:

- Stay home if someone is suffering from this illnesses:
  - Hepatitis A
  - Shigella
  - E-Coli Infection
  - Salmonella
- Medicines should be kept inside the locker and away from foods
- Clean and cover cuts and wounds
- Never use bare hands when handling ready to eat foods
- Disposable gloves should be used once
- Take a bath everyday
- Wear appropriate attire
- Refrain from wearing jewelry, make ups, and nail polish
- Observe proper hand washing procedures at all times

4. POTENTIALLY HAZARDOUS FOODS –

Food most likely to become unsafe typically has the following characteristics:

- Water activity level of .85
- Ph level 4.6 to 7.5
- High protein content

Examples:

1. Fish
2. Meat (beef, pork, lamb)
3. Milk & milk products
4. Cooked rice, beans
5. Textured Soy Protein
6. And meat alternatives
7. 6. Poultry
8. 7. Sea foods
9. 8. Sprouts & raw seeds
10. 9. Sliced melons
11. Eggs
12. Baked/boiled potatoes
13. Garlic in Oil Mixture
CHAPTER 2
UNDERSTANDING MICROORGANISMS

• Definition of terms:
  1. *Pathogens* - are disease causing microorganisms (bacteria, viruses, parasite and fungi)
  2. *Bacteria* - single celled living micro organisms responsible for the decay of many plant and animal diseases.
  3. *Virus* - The smallest of the microbial food contaminants, viruses rely on a living host to reproduce.
  4. *Parasite* - An organism that needs a living host to survive.
  5. *Fungi* - can be single celled or multi cellular microorganisms can that can cause food spoilage and lives by absorbing nutrients from organic matter
  6. *pH* - – potential of Hydrogen. A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, with increasing alkalinity and decreasing with increasing acidity. The pH scale commonly in use ranges from 0 to 14.
  7. *Spore* - The spore is formed by some bacteria, thickens walls to protect from adverse condition such as extreme acidity and temperature.
  8. *Vegetative Stage* - is a condition favorable for bacteria to grow and multiply rapidly.
  9. *Budding Reproduction* - – a form of asexual reproduction where in new bud or bump is formed from the mother cell.
  10. *Water Activity* – The amount of moisture available in food for microorganisms to grow.

**BACTERIA**

- Bacteria consist of only a single cell (unicellular)
- Bacteria reproduce through “binary fission” when one cell divides to form two new cells
- All bacteria exist in a vegetative stage
- Some bacteria has the ability to form a spore where they can survive in an adverse or extreme conditions “spore forming bacteria”
- Bacteria are “photosynthetic”, they have the ability to make their own food through the use of the sunlight, thus bacteria also gives off oxygen.
- An average bacterium measures 1 micrometer

Classification of Bacteria:
  1. Spoilage Bacteria – where they breakdown foods so they look, taste and smell bad. Thus, food is undesirable to eat and unacceptable.
2. Pathogenic Bacteria – are disease causing bacteria that can make people ill if they or their toxins are consumed with foods.

Shapes of bacteria:
1. Coccus or Cocci – spherical shaped bacteria
2. Bacillus or bacilli – rod shaped bacteria
3. Spirilla - spiral shaped bacteria

How they move?
• Bacteria use it’s “flagella”, a hair like appendages use to swim around.
• Some stick out thin, rigid spikes called “fimbriae” to help hold them to surfaces.

4 Phases of Growth of Bacteria:
1. Lag Phase – bacteria adapt themselves to growth conditions. It is the period where the individual bacteria are maturing and not yet able to divide.
2. Log Phase or Logarithmic Phase – “exponential phase” growth is very rapid, doubling in numbers in every few minutes
3. Stationary Phase - the growth rate slows as a result of nutrient depletion and accumulation of toxic products. This phase is reached as the bacteria begin to exhaust the resources that are available to them.
4. Death or Decline Phase - bacteria run out of nutrients and die

6 Conditions Bacteria Needs to Grow and Multiply
1. Food
2. Acidity
3. Temperature
4. Time
5. Oxygen
6. **Moisture**

**Food:**

- Bacteria feed on Protein and Carbohydrates. Foods that contain these items can support the growth of microorganisms.
- Potentially Hazardous Foods have the potential for contamination, they have the characteristics to allow microorganisms to grow and multiply.

How to Control the Growth of Bacteria in Food
1. Purchase from reputable suppliers
2. Avoid cross-contamination of food
3. Cook food to safe internal temperature and test with food thermometer

**Acidity:**

- Bacteria grows best at a slightly acidic and slightly neutral environment (pH 4.6 to 7.5).
- Some bacteria can develop a “spore” such as **acidophilic bacteria**, where it could grow and multiply in an acidic environment.
- Bacteria such as E-Coli can grow in unpasteurized apple that has a pH value of 4.0.

<table>
<thead>
<tr>
<th>pH Value</th>
<th>Acidic</th>
<th>Neutral</th>
<th>Alkaline</th>
</tr>
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<tbody>
<tr>
<td>Below 4.6</td>
<td>Bacteria will not grow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 4.6 to 7.0</td>
<td>Bacteria will thrive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between 7.0 to 9.0</td>
<td>Bacteria may survive</td>
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How to Control Acidity to Control the Growth of Bacteria:
1. Highly acidic foods such as vinegar and lemon inhibit the growth of microorganism.
2. Salad dressing made with vinegar, oil and garlic can make as a marinade for meat

**Time**

- Under ideal conditions, bacterial cells can double in number every 25 minutes to 30 minutes.
- Pathogens starts to multiply in four hours at the Temp. Danger Zone.
How to Control Time to Control the Growth of Bacteria
1. Store received foods as quickly as possible to limit the time in Temp. Danger Zone
2. If the foods will not be cooked or served right away, store it inside the refrigerator or freezer
3. Check temperature on holding cabinets, make sure that it maintains the internal of 135°F and above
4. Document food inside the storage room, practice First In First Out
5. Reheat foods at the internal temperature of 165°F for 15 seconds

Temperature

- Temperature Danger Zone - temp. range 41°F-140°F (5°C-60°C). Food borne bacteria grow and reproduce.
- Temperature Abuse – foods that have not been to a safe temperature or kept at the proper temperature
- Psychrophilic bacteria – grow within the temperature range of 32°F(0°C) – 70°F (21°C) (spoilage organisms)
- Mesophilic bacteria – grow at temp. 70°F(21°C) – 110°F(43°C)
- Thermophilic bacteria – grows best above 110°F (43°C)

How to Control Temperature To Control The Growth of Bacteria
1. Cold foods, must be stored 41°F or below
2. Hot foods, must be held at 140°F (60°C) and above
3. Control the temperature of food during storing, preparing, cooking, holding, re-heating, serving.
4. Check internal temperature regularly
5. Cook foods at a required internal temperature with a food thermometer
6. Keep foods out of Temperature Danger Zone

Oxygen

Bacteria differ in their oxygen requirement.
Anaerobic bacteria – cannot survive when oxygen is present bec. it is toxic to them.
Anaerobic bacteria grow well in vacuum packaged foods or canned foods where oxygen is not available.
Aerobic bacteria – need oxygen to grow
Facultative anaerobic bacteria – can grow with or without free oxygen but have a preference
Microaerophilic organisms – can survive in a very little amount oxygen
Microbes are single-celled organisms that can perform the basic functions of life — metabolism, reproduction, and adaptation.

Viruses can’t metabolize nutrients, produce and excrete wastes, move around on their own, or even reproduce unless they are inside another organism’s cells.

They aren’t even cells.

**Bacteria remain alive and become potentially hazardous when moisture is added**

**How to Control Oxygen to Control the Growth of Microorganism**

1. Bacteria grow in different oxygen requirement, it is difficult to control this condition.
2. Bacteria such as Clostridium Botulinum and Clostridium Perfringens live without the presence of oxygen, it is important to cool foods in a shallow pan.

**Moisture**

Moisture is important factor in bacterial growth. The amount of water available for bacterial activity.

- *Water Activity level* — is the measure of the amount of water that is not available for bacterial to grow. (0-10)
- *Potentially hazardous foods* (PHF) — foods that have a water activity level of .85 or higher

**How to Control Moisture to Control the Growth of Microorganism**

1. Lower the amount of moisture in food through freezing, dehydrating, adding sugar or salt.

Viruses are the simplest and tiniest of microbes; they can be as much as 10,000 times smaller than bacteria.

Viruses comes in many sizes and shapes

Viruses consist of a small collection of genetic material (DNA or RNA) encased in a protective protein coat called a capsid.

Some may survive in freezing and cooking
PARASITE

• A parasite is an organism that lives by feeding upon another organism. Parasites living in the human body feed on our cells, our energy, our blood, the food we eat and even the supplements we take.
• There are several types of parasites: protozoa are single celled organisms that are only visible under a microscope, while worms come in all sizes from threadworms, that measure less than one centimeter, to tapeworms that grow up to 12 meters in length.
• They grow naturally in many animals such as pigs, cats and rodents
• They can be killed by proper cooking or freezing

How can I get a Parasite?

• Contaminated or unfiltered water
• Contaminated soil
• Contaminated fruits and vegetables
• Raw or rare meat
• Pets Mosquitoes Contact with feces
• Contact with someone with parasites

FUNGII

• Fungi are a group of organisms and micro-organisms that are classified within their own kingdom, the fungal kingdom, as they are neither plant nor animal.
• Fungi draw their nutrition from decaying organic matter, living plants and even animals.
• Many play an important role in the natural cycle as decomposers and return nutrients to the soil, they are not all destructive.
• Fungi usually reproduce without sex. Single-celled yeasts reproduce asexually by budding.

Examples of Fungi are:
1) Mold
   ➢ Mold cause spoilage in food and could cause illnesses
   ➢ They grow under almost any conditions, but grow well in sweet, acidic food with low water activity.
   ➢ Freezing temperatures prevent or reduce the growth of molds, but not destroyed
   ➢ Some molds produce called “aflatoxins”
2) Yeasts
   ➢ Yeast also cause food spoilage
   ➢ Yeast spoilage produce a smell or taste of alcohol. They appear in pink color discoloration
They also grown well in sweet, acidic foods with low water activity level
Such as jellies, honey and fruit juices

CHAPTER 3
Food borne Illnesses

Illnesses Caused by
Bacteria

Bacteria are classified as “spore forming” and “non
spore forming”

Spore – enables a cell to survive environmental
stress such as cooking, Freezing, high salt
condition, drying and high acid condition.

1) Botulism (*spore forming)  
_Bacteria : Clostridium Botulinum_  
Anaerobic bacteria

- Organism produce a neurotoxin, deadly biological toxin to man

Type of Illness: Bacterial intoxication
Symptoms : Dizziness, double vision, difficulty in breathing and swallowing
Onset time : 12-36 hrs.
Food Sources : Improperly canned foods, vacuum packed, Refrigerated foods
Prevention : Discard bulging cans, Do not use home canned foods
               Do not mix and store oil and garlic, saute’ onion as needed
               Don’t store left over potatoes in a foil

2. Campylobacteriosis  
_Bacteria : Campylobacter Jejuni_  

- It requires a very strict amount of air for growth (microaerophilic)

Type of Illness : bacterial infection
Symptoms : watery, bloody diarrhea, fever, nausea, vomiting, abdominal pain,
            Headache, muscle pain
Onset time : 7-10 days
Food Sources : Unpasteurized milk, raw poultry, beef, fecal contaminated water
Prevention :
  - Personal hygiene
  - Follow hand washing guidelines
  - Avoid cross contamination
  - Cook all meat
• Maintain good pest control
• Use pasteurized dairy products
• Use safe water

3. E- Coli Infection

Bacteria: *Escherichia coli*
- Produce Shiga Toxin, a poisonous substance
- Facultative anaerobic bacteria
Type of Illness: Bacterial Infection
Onset time: 3-8 days
Symptoms: Bloody diarrhea followed by kidney failure
Food Sources: undercooked ground beef, unpasteurized apple juice, undercooked fruits and vegetables, raw milk, dairy products

Prevention
- Good personal hygiene
- Avoid cross contamination
- Cook all poultry, meat carefully
- Use pasteurized milk and dairy products
- Wash all fresh fruits & vegetables in a clean running water

4. Listeriosis

Bacteria: *Listeria Monocytogenes*
- Facultative anaerobic bacteria, ability to survive in high salt foods, and can grow at refrigerated temperature.
Type of Illness: Bacterial Infection
Onset time: 3-70 days
Symptoms: headache, stiff neck, confusion, loss of balance, convulsion, dangerous for pregnant women (result to premature delivery, fetal death)

Food Sources
- raw milk, meat
- refrigerated ready to eat foods
- processed foods (hotdogs, deli meats, luncheon meats)
- soft cheeses

Prevention
- Good personal hygiene
- Avoid cross contamination
- cook all meat, poultry carefully
- Use pasteurized milk, milk products
- Wash all fruits & vegetables in a clean running water
- Clean & sanitized utensils & equipment
5. **Perfringens foodborne illness**

*Bacteria*: Clostridium perfringens

- Microaerophilic bacteria

**Type of Illness**: Bacterial toxin mediated infection

**Onset time**: (8-22 hrs.)

**Symptoms**:
- Severe abdominal cramps
- Severe diarrhea

**Food Sources**
- Cafeteria germs
- Spices, gravy
- Improperly cooled foods
- Foods not cooked to the right temperature

**Prevention**
- Good personal hygiene
- Avoid cross contamination
- Cook all meat carefully

6. **Salmonellosis**

*Bacteria*: Salmonella bacteria

- Facultative anaerobic bacteria
- Fecal contamination

**Type of Illness**: Bacterial infection

**Symptoms**: Stomach cramps, diarrhea, head ache, nausea, fever, vomiting

**Food Sources**
- Contaminated by soil, insects, intestinal waste of animals
- Raw meat, fish, eggs
- Raw salad dressing, cake mixes, sliced fruits & vegetables
- Dried gelatin, peanut butter

**Prevention**
- Good personal hygiene
- Avoid cross contamination
- Cook all meat carefully
7. **Shigellosis**

**Bacteria:** Shigella bacteria

- Facultative anaerobic bacteria
- Comes from human intestines, polluted water, spread by flies and food handlers

**Type of Illness:** Bacterial infection

**Symptoms:** Diarrhea, fever, abdominal cramps, dehydration

**Food Sources:** foods that are prepared by human contacts, salads, ready to eat meats, pasta salads, lettuce, moist foods

**Prevention**
- Good personal hygiene
- Avoid cross contamination
- Use clean water
- Control flies
- Cook foods properly

8. **Staphylococcal illness**

**Bacteria:** Staphylococcus aureus

- Facultative anaerobic bacteria. Can grow in cooked or safe foods that are recontaminated
- Commonly found in human skin, hands, hair, nose and throat.
- Carrier are healthy and unhealthy people
- Can grow in high salt or high sugar, and lower water activity

**Type of Illness:** Bacterial intoxication

**Symptoms:** nausea, vomiting, abdominal cramps, headaches

**Food Sources**
- Foods that are prepared by human contacts
- Left over, meat,
- Eggs, egg products,
- Potato salad, salad dressings

**Prevention**
- Good hygiene
- Avoid cross contamination
- Cover a burn or cut wounds
- Wear a disposable gloves when preparing foods
- Cook foods thoroughly
Illnesses caused by Viruses

The viruses foodborne disease differ from bacteria:
1) They can only multiply inside the living host
2) Viruses do not multiply in foods.
3) Viruses are usually transferred from one food to another.
4) From a food handler to food and water
5) A potentially hazardous food is not needed to support survival of virus

1. **Hepatitis A**
   - **Virus**: Hepto Virus or a Hepatitis A virus
   - Found in human intestinal and urinary tract and contaminated water
   - **Symptoms**: fever, fatigue, headache, nausea,
     - loss of appetite, stomach pain, vomiting, “jaundice”
   - **Incubation time**: 2-10 months after contaminated food and water is consumed
   - **Food sources**: 1) Raw and lightly cooked oyster and clams harvested from polluted water
   2) Raw vegetables irrigated and washed in polluted water
   3) Potentially hazardous food handled by a person infected with hepa A that needed no further cooking
   - **Prevention**: 1. Handle foods properly
     2. Cook the at recommended temperature
     3. Avoid eating raw seafoods
     4. Food handlers must practice good personal hygiene
     5. Wash hands and fingernails properly

2. **Norwalk Virus**
   - **Virus**: Norwalk virus
   - **Symptoms**: nausea, vomiting, diarrhea, abdominal pain, headache, low grade fever
   - **Food Sources**: contaminated water, shellfish from contaminated water,
     - contaminated fruits and vegetables
   - **Prevention**: Cook foods to a proper temperature, practice good personal hygiene,
     - wash hands and fingernails

3. **Rota Virus**
   - **Virus**: Cause diseases like rota virus gastroenteritis
   - **Symptoms**: vomiting, low grade fever, watery diarrhea
   - **Transmission**: person to person spread through contaminated hands
Prevention: Cook foods properly, practice good personal hygiene

Illnesses Caused by Parasites

Parasite is a biological hazard. They need a living host to survive. Parasites can enter a food system and can cause food borne illnesses

1. Anisakis
Parasite: Anisakis spp. Are nematodes (roundworm)
- Associated with food borne infection from fish.
- Anisakis is about 1- 1 ½ inches long and a diameter of human hair.
- They are beige, ivory, white, gray, brown or pink.
Symptoms:
- Vomiting, abdominal pain if the worm is attached to the stomach
- Coughing if the worm is attached to the throat
- Sharp pain, fever if the worm is attached to the large intestines
Food Sources:
1. Raw undercooked seafoods
2. Bottom feeding fish (cod, salmon, herring, flounder)
3. Human are accidental host upon eating fish infested with parasite

2. Cyclosporiasis
Prevention: cook seafoods at proper temperature
Parasite: Cyclospora cayetanisis
Symptoms: infections that infect the small intestines
1. Watery diarrhea
2. Loss of appetite
3. Bloating
4. Stomach cramps
5. Nausea
6. Vomiting
7. Low grade fever
Food Sources: Berries, lettuce, fresh herbs
3. **Giardiasis**
Parasite: *Giardia doudenalis*
- A single cell microorganism called “protozoa”
Symptoms:
- diarrhea, stomach cramps, nausea
Food Sources: undercooked pork

4. **Trichonosis**
Parasite: *Trichiniella spiralis*
- This parasite looks like a small, hairy round worm
Symptoms: nausea, vomiting, abdominal pain, later stage are fever, swelling of tissues around the eyes, muscle stiffness, death
Food Sources:
- Undercooked pork and sausages
- Ground meats contaminated through meat grinders

### Illnesses Caused by Fungi

Molds, yeast and other fungi cause food spoilage

1) **Molds**
- individual mold cells are microscopic, they grew quickly and they become visible
- Molds spoil foods, causing discoloration, and unpleasant smell
- Molds grow in any conditions (moist, dry, acidic, salty, sweet, cold, warm)
- Mold produce toxins, some of which relate to cancer and cause allergies
- Aflatoxin can cause liver disease
- Molds can be used to make cheese such as Brie, Camembert, Gorgonzola, Bleu cheese
- Although the cells and spores can be killed by heating to 140°F for 10 minutes, the toxins are heat stable and are not destroyed

3. **Yeast**
- Like molds, yeast can cause food spoilage
- Foods such as jellies, honey, syrup, fruit juices are most likely loved by yeast
- Evidence of bubbles, and alcoholic smell or taste are the sign where foods have the presence of yeast
- Discard any foods that has the evidence of yeast
Foodborne Illnesses Caused by Naturally Occurring Chemicals

Naturally occurring chemicals include toxins that are produced by a biological organism.

1. **Food Allergens** - Cause the immune system to overreact
   - Symptoms: Hives, swelling of the lips, tongue and mouth, difficulty in breathing, vomiting, diarrhea and cramps.
   - Common Food Allergens:
     - Milk
     - Soy
     - Egg
     - Fish
     - Wheat proteins
     - Shell fish
     - Peanuts
     - Chicken

2. **Ciguatoxins** – intoxication caused by eating contaminated tropical reef fish. The toxin is found in algae and then eaten by reef fish, which is eaten by big fish such as barracuda, mahi, bonito, jack fish, snapper, in which the toxin is accumulated in the flesh of these fishes.
   - Symptoms: nausea, vomiting, diarrhea, dizziness, shortness of breath
   - Common Foods: Barracuda, mackerel, snapper, triggerfish
   - Prevention: Toxin is not destroyed by cooking. Purchase sea foods from Reputable supplier

3. **Scombrotxin** – called ‘histamine” poisoning, caused by eating food high in a chemical compound called “histamine” which produced by certain bacteria. Leaving fish at room temperature usually result in histamine production.
   - Symptoms: dizziness, burning sensation, facial rash, shortness of Breath, peppery taste in the mouth.
   - Common Foods: tuna, anchovies, blue fish, mackerel, amberjack, Dark meat fishes.
   - Prevention food at Temperature between 32⁰F (0⁰C)-39⁰F (4⁰C).
     - Do not accept seafood that is suspected being thawed and Refrozen or temperature abused.

4. **Shellfish Toxin** – toxins are produced by certain algae called “ dinoflagellates” when eaten by certain shellfish such as mussels, clams, oysters
   - Scallop accumulate in their internal organs and become Toxic to humans.
   - Common Foods: Mussel, clams, oysters, scallop
   - Prevention: Purchase shellfish from reputable supplier
5. **Mycotoxins** – Fungi are molds, yeast and mushrooms, some of which are causing food borne illnesses. Molds and yeast can withstand more extreme condition than bacteria.

- Many mycotoxin have been shown to cause cancer.
- “aflatoxin” is produced by certain mold

<table>
<thead>
<tr>
<th>Common Foods</th>
<th>: More drier and acidic food such as corn, corn products, peanuts, Pecans, walnuts and milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevention</td>
<td>: Purchase food from reputable supplier. Store grains and nuts in a Dry and protected from humidity area</td>
</tr>
</tbody>
</table>

**Toxin is not destroyed by cooking**
CHAPTER 4
SANITARY FACILITIES & PEST MANAGEMENT

Food Safe Facility Operation
A food safe food service begins with a facility that is clean and good repair. It is important to eliminate hard to clean areas and faulty equipment. Get rid of dirty surroundings that will attract bugs and other pests.

Characteristics of Food Safe Facilities:

Ceiling, Walls & Floors
- Clean walls with cleaning solution daily
- Sweep and vacuum floors daily. Spills should be clean immediately
- Swab ceilings instead of spraying them, to avoid soaking lights and ceiling fans
- Clean light fixtures with sponge or cloth
- Establish a routine cleaning schedule

Ventilation
- Use exhaust fan to remove odors and smoke
- Use hood over cooking areas and dishwashing equipment
- Check exhaust fan and hood regularly, make sure it is working and cleaned properly
- Clean hood filters regularly as instructed by the manufacturer

Rest rooms
- Warm water at 100°F for hand washing
- Liquid soap, toilet paper, paper towels or hand dryer should have adequate supply
- Garbage can should have a foot pedal cover
- Door should be self closing
- Remove trash daily

Garbage & Garbage Collections
- Garbage must be kept away from food preparation areas.
- Garbage containers must be leak proof, water proof, pest proof and durable,
- Garbage should be cleaned and sanitized regularly inside and out

Pests
- Cockroaches
  - Any place that is dark, warm, moist and hard to clean
  - Holes, boxes, seams of bags folds of paper
  - Seeing one in day is sign of serious infestation
  - Strong oily odor
  - Feces like pepper grains
• Dark capsule-shaped egg cases

- Flies
  - Enter through tiny holes size of pinhead
  - Contaminate with mouth, hair, feces, feet
  - Lay eggs in warm decaying material, away from sun

- Rodents
  - Signs:
    - Droppings
    - Gnawing
    - Tracks in dust
    - Nesting materials
    - Holes in baseboards and walls

Pest Control Program
  - Cleanliness and maintenance are keys in preventing pest infestation.

By nature food service environment is prone to problems with pests. Pest may be brought in when other foods and other supplies are delivered. They may also enter the building through gaps in floors or walls.
  - Have ongoing pest prevention program and regular pest control by a licensed pest control operator
  - Fill in opening or cracks in walls and floors
  - Fill opening on pipes or equipment fittings
  - Screen all windows, doors, and other outer. Keep them in good repair
  - Use self open door that open outward
  - Inspect food supplies before storing or using them
  - Keep foods in a tight fitting lid containers
  - Don’t store foods directly on the floor
  - Remove and destroy food that is infested
  - Maintain proper temperature in storage areas
  - Clean grease traps regularly to prevent drain blockage which causes unpleasant odor that may attract pests.

Sanitizing Small & Large Equipment

Small Wares: Include dishes, flatware, preparation and serving utensils, Measuring devices, cooking pots and pans

Clean – to remove visible dirt
Sanitize – absence of microorganism through using heat or chemicals

Clean Agents : are chemical compounds that remove food, soil, soil, rust stains, minerals
4 Types of Cleaning Agents:
1. Detergents – all detergents contain surfactants that reduce surface tension between the soil and the surface.
2. Solvent cleaners – called “degreasers”, solvent cleaners alkaline detergent that contain a grease-dissolving agent. Work well in areas where grease has been burned on.
3. Acid Cleaners – Used on mineral deposits and other soils alkaline cleaners can’t remove, these cleaners are often used to remove scale in ware washing machine.
4. Abrasive Cleaners – it contain a scouring agent that helps scrub off hard to remove soil.

2 Ways in Sanitizing:
- **Chemical** – accomplished by immersing or wiping with sanitizing solution and allowing the solution to remain in contact in a solution for a specified amount of time.
- **Heat** – exposing the equipment to high heat for an adequate length of time. This is done manually by immersing equipment into water at 171°F-191°F for at least 30 seconds.

3. Most Common Chemical Sanitizers:
1. **Chlorine** – most commonly used and the least expensive.
   - It is effective in hard water, but it is inactivated in hot water above 120°F.

<table>
<thead>
<tr>
<th>Rule of Thumb Mixture For Chlorine Sanitizing Solution:</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 PPM Solution : 1 Tablespoon (5% commercial chlorine solution) Mixed with 4 gallons of water, and sanitized the solution for 7 seconds at temp. 75°F-115°F. Use to sanitize food thermometers</td>
</tr>
<tr>
<td>100 PPM Solution : 1 Tablespoon mixed with 2 gallon of water</td>
</tr>
<tr>
<td>200 PPM Solution : 1 Tablespoon mixed with 1 gallon of water</td>
</tr>
</tbody>
</table>

**PPM** – Per Million Parts
Chlorine is inactive in hot water
2. **Iodine** – Effective at low concentrations.
   - Not as quickly inactivated by soil as chlorine.
   - Less effective than chlorine
   - Becomes corrosive to some metals at temp. above 120°F
   - More expensive than chlorine
   - May stain surfaces

3. Quaternary Ammonium Compounds (Quats)
   - Not as quickly inactivated by soil as chlorine
   - Remain active for a short period of time after it has been dried
   - Noncorrosive
   - Non irritating to skin
   - Works in most temperature and pH ranges
   - Leaves a film on surface
   - Does not kill certain types of microorganisms
   - Hard water reduces effectiveness

---

**Sanitize Small Equipment at 3 Compartment Sink**

Step 1: Rinse
   - Scrape
   - Soak

Step 2: Wash
   - (110°F)

Step 3: Rinse
   - (110°F)

Step 4: Sanitize
   - 171°F for 30 seconds

**Sanitizing Large Equipment**

Step 1 : Unplug electrically powered equipment
Step 2 : Remove loose food particles and scraps
Step 3 : Wash, rinse, and sanitize any removable parts using the manual immersion method
Step 4 : Wash the remaining food-contact surfaces and rinse with clean water.
          Wipe down with a chemical sanitizing solution.
Step 5: Clean surfaces that do not come in contact with food using a clean wiping cloth. Allow all parts to air dry before re-assembling. Clean the wiping cloth before and during use by rinsing in a sanitizing solution.

Step 6: Re-sanitize the external food-contact surfaces of the parts that were touched when the equipment was re-assembled.

CHAPTER 5

PREVENTING FOODBORNE ILLNESS DURING EIGHT STEPS OF FOOD SERVICE PROCESS

This chapter explains how each step of the foodservice process affects food safety and provides guidelines for ensuring food safety in each step.

8 Steps of Food Service Process:

1. Purchasing
2. Receiving
3. Storing
4. Preparing
5. Cooking
6. Holding & Serving
7. Cooling
8. Reheating

A. 8 Steps of Food Service Process

Step 1: Purchasing

a. Guidelines for Purchasing

Vendor:

➢ Meet Public Health standards
➢ Train employees for sanitation
➢ Have a clean delivery trucks with adequate refrigeration and freezer
➢ Deliver foods in protective, leak proof, durable packaging
➢ Organize deliveries to separate raw products from processed foods and produced

Purchaser:

➢ Work with vendor
➢ Food delivery schedule
➢ Vendor standardized procedures in print
➢ Purchase specification
➢ Vendor sanitation report
➢ Visit warehouse periodically
➢ Reject all products that does not meet requirement
Food Safety Guidelines for Receiving

- Train employees for receiving duties
- Organize space, equipment and lighting for receiving efficiency
- Inspect delivery trucks
- Inspect food immediately

**Step 2 : Receiving**

Criteria in Receiving Foods (Checklists)

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>ACCEPT</th>
<th>REJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td><strong>Color</strong>: bright cherry red</td>
<td><strong>Color</strong>: brown, greenish, purple blotches</td>
</tr>
<tr>
<td>Pork</td>
<td><strong>Pink lean, white fat</strong></td>
<td><strong>Texture</strong>: slimy, sticky, dry</td>
</tr>
<tr>
<td></td>
<td><strong>Texture</strong>: firm, spring back when touched</td>
<td><strong>Packaging</strong>: broken cartons, Dirty wrappers, torn packaging</td>
</tr>
<tr>
<td>Beef</td>
<td><strong>Pork</strong></td>
<td></td>
</tr>
<tr>
<td>Poultry</td>
<td><strong>Color</strong>: no discoloration</td>
<td><strong>Color</strong>: purple, green discoloration</td>
</tr>
<tr>
<td></td>
<td><strong>Texture</strong>: firm, springs back when touched</td>
<td><strong>Texture</strong>: stickiness under the wings or around the joints</td>
</tr>
<tr>
<td></td>
<td><strong>Freezer burn, dark wing tip</strong></td>
<td><strong>Odor</strong>: abnormal, unpleasant</td>
</tr>
<tr>
<td>Fish</td>
<td><strong>Color</strong>: bright red gills, bright shiny skin</td>
<td><strong>Color</strong>: dull, gray gills, dull, dry skin</td>
</tr>
<tr>
<td></td>
<td><strong>Odor</strong>: mild ocean, seaweed smell</td>
<td><strong>Odor</strong>: strong, fishy ammonia smell</td>
</tr>
<tr>
<td></td>
<td><strong>Eyes</strong>: bright, clear, full</td>
<td><strong>Eyes</strong>: cloudy, red rimmed, sunken</td>
</tr>
<tr>
<td></td>
<td><strong>Texture</strong>: firm flesh, springs back when touched</td>
<td><strong>Texture</strong>: soft, leaves imprints when touched</td>
</tr>
<tr>
<td>Shellfish</td>
<td><strong>Odor</strong>: mild ocean, seaweed smell</td>
<td><strong>Odor</strong>: strong fishy smell</td>
</tr>
<tr>
<td></td>
<td><strong>Shells</strong>: closed, unbroken (indicates shell Fish is alive)</td>
<td><strong>Shells</strong>: open, do not close when Tapped</td>
</tr>
<tr>
<td></td>
<td><strong>Shells</strong>: hard and heavy</td>
<td></td>
</tr>
<tr>
<td>Crustacea (shrimp, crabs)</td>
<td><strong>Odor</strong>: mild ocean, seaweed smell</td>
<td><strong>Odor</strong>: strong fishy smell</td>
</tr>
<tr>
<td></td>
<td><strong>Shell</strong>: hard and heavy</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Shell</strong>: soft</td>
<td></td>
</tr>
<tr>
<td>PRODUCT</td>
<td>ACCEPT</td>
<td>REJECT</td>
</tr>
<tr>
<td>---------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Eggs</td>
<td>Odor: none</td>
<td>Odor: sulfur smell</td>
</tr>
<tr>
<td>Receive at 45°F or lower</td>
<td>Shells: clean, unbroken chalkly</td>
<td>Shells: dirty cracked, shiny</td>
</tr>
<tr>
<td>Dairy (milk, butter, cheese)</td>
<td>Milk: sweet flavor</td>
<td>Milk: sour, bitter, moldy taste, putrid odor, curdled consistency</td>
</tr>
<tr>
<td>Receive at 41°F or lower</td>
<td>Butter: sweet flavor, uniform color</td>
<td>Expired dates</td>
</tr>
<tr>
<td></td>
<td>Firm texture</td>
<td>Butter: sour, bitter, moldy taste</td>
</tr>
<tr>
<td></td>
<td>Cheese: typical flavor, uniform color</td>
<td>Cheese: unnatural mold, uneven color, abnormal flavor and color</td>
</tr>
<tr>
<td>Frozen Processed Foods (cold cuts, frozen fruits &amp; veg)</td>
<td>Package intact and in good condition</td>
<td>Torn packages, with holes</td>
</tr>
<tr>
<td>Receive at 41°F or lower</td>
<td>Presence of small crystals</td>
<td>Appearance of large crystals (evidence of thawing and refreezing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fluids and frozen liquids at the bottom</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Water stains in the package</td>
</tr>
<tr>
<td>Ice Cream</td>
<td>Tightly sealed cartons, no ice crystals</td>
<td>Large crystals</td>
</tr>
<tr>
<td>Receive at 6°F-10°F</td>
<td>Indicating thawing and refreezing</td>
<td></td>
</tr>
<tr>
<td>Canned Goods</td>
<td>Packaging intact</td>
<td>Swollen, leaking, rusty, dented cans, flawed seals, without label</td>
</tr>
<tr>
<td>Dry Foods</td>
<td>Packaging intact, dry undamaged</td>
<td>Damp moldy container, Insect infestation</td>
</tr>
</tbody>
</table>

Types of Thermometer:

1) **Bi Metallic Stemmed Thermometer** - most commonly used in the food service operations.
   - Reads in 1-2 minutes
   - Place 2-2½" deep in thickest part of food
   - Can be used in roasts, casseroles, and soups
   - Not appropriate for thin foods
   - Can remain in food while it's cooking
   - Heat conduction of metal stem can cause false high reading
Calibrating Thermometers

1) Ice Point Method:
The ice point method is used most often unless a thermometer cannot register a temperature of 32°F (0°C)
- Fill a glass with crushed ice. Add water until glass is full.
- Place thermometer in the center of the glass of ice water, not touching the bottom or sides of the glass.
- Agitate the glass of ice water to ensure even temperature
- Temperature should register at 32°F
- Adjust the calibration nut by holding it with pliers. If using digital thermometer, push the reset button to 32°F

2) Boiling Point Method:
This method may be less reliable than ice point method because of variation due to high altitude.
- Using a deep pan, bring the water into boil
- Place thermometer in the center of the pan boiling water, not touching the bottom or sides of the pan. Wait until indicator stops.
- The temperature should hold the temperature of 212°F. Adjust the calibration nut by holding it with pliers and set to read at 212°F. If using digital thermometer, push the reset button to 212°F while the water is still boiling.
- For high altitude, for each 550 feet above sea level, the boiling point of water is 1°F lower than the standard of 202°F.

Using Temperature
- Clean and sanitize after every use.
- Wait till rests; 15 seconds
- Take three measurements
- Calibrate Routinely
- Insert thermometer stem or probe into thickest part of product
- Never use mercury or spirit-filled glass thermometers to check food temperature
Checking Temperature of Various Food

- Packaged – insert between two packages
- Milk – open a carton and insert two inches in
- Frozen – insert between two packages

Step 3 : Storing

Food Safety Guidelines for Storing:

- **Dry storage** - long holding for less perishable items
- **Refrigerator** - short-term for perishable items
- **Deep-chilling** - unit-spec. foods for short time
- **Freezer** - long term food storage

Types of Storage Areas

**Dry Storage**

Foods Typically Store in Dry Storage

- Canned goods, baking supplies (salt, sugar), grains (rice, cereals)
- Some fruits (banana, avocado, pears)
- Some vegetables (onion, potatoes)

Guidelines for Dry Storage

- Maintain storage temperature (50°F-70°F)
- Keep store room clean and dry
- Have a regular cleaning schedule for all surface and floors
- Store all foods and office supplies 6 inches above the floor and 6 inches away from the wall.
- Keep food in labeled, tight fitting containers with name and delivery date
- Use the First In First Out method of inventory. Store new products behind the old products
- Protect food from contamination with regular pest control
- Store chemicals away from food
- Look for damaged, spoiled foods, bulging cans, infested packages, and foods immediately and clean the area thoroughly
- Discard or destroy all contaminated foods
**Cold Storage**

**Refrigerator Storage**

<table>
<thead>
<tr>
<th>Cooked &amp; Ready To Eat Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
</tr>
<tr>
<td>Whole Meat</td>
</tr>
<tr>
<td>Ground Meat</td>
</tr>
</tbody>
</table>

**b. Storage Guidelines (Cold)**

- Arrange food in refrigerators to allow maximum air circulation
- All food should be labeled with the following (name of the food item, date, time, temperature)
- Store food in a clean, non-absorbent, covered container. Be sure all containers are properly sealed
- Cool hot foods using an ice water bath, and stirring with cold paddles before storing inside the refrigerator. Never place hot foods in the refrigerator. This allows other foods under Temp. Danger Zone
- Store dairy products separately with foods in strong odor (onion, cabbage, and seafoods)
- Store fruits in a separate section in a refrigerator from vegetables. The ethylene gas released by some fruits during ripening causes some vegetables to deteriorate rapidly.
- To avoid cross contamination, store raw foods, uncooked foods away or below from prepared or ready to eat food.
- Never allow fluids from raw poultry, fish or meat to come into contact with other foods.
- Don’t overload the refrigerator
## Recommended Temperature and Max. Period of Storage for Selected Food Items

<table>
<thead>
<tr>
<th>FOOD</th>
<th>°TEMP °F</th>
<th>°TEMP °C</th>
<th>MAX. STORAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canned Products</td>
<td>70</td>
<td>21</td>
<td>12 months</td>
</tr>
<tr>
<td>Cooked dishes</td>
<td>36</td>
<td>3</td>
<td>served on day prepared</td>
</tr>
<tr>
<td>Cream filled pastries</td>
<td>36</td>
<td>3</td>
<td>served on day prepared</td>
</tr>
<tr>
<td>Dairy products milk (fluid)</td>
<td>40</td>
<td>5</td>
<td>3 days in orig. container tightly covered</td>
</tr>
<tr>
<td>Milk (dried)</td>
<td>70</td>
<td>21</td>
<td>3 months orig. container</td>
</tr>
<tr>
<td>Butter</td>
<td>40</td>
<td>5</td>
<td>2 weeks in waxed carton</td>
</tr>
<tr>
<td>Cheese (hard)</td>
<td>40</td>
<td>5</td>
<td>6 months tightly wrapped</td>
</tr>
<tr>
<td>Cheese (soft)</td>
<td>40</td>
<td>5</td>
<td>7 days, tightly covered</td>
</tr>
<tr>
<td>Ice cream &amp; Ices</td>
<td>10</td>
<td>-12</td>
<td>3 months orig. container</td>
</tr>
<tr>
<td>Eggs</td>
<td>45</td>
<td>7</td>
<td>7 days unwashed not in cardboard</td>
</tr>
<tr>
<td>Fish, shellfish (fresh)</td>
<td>36</td>
<td>2</td>
<td>2 days loosed wrapped</td>
</tr>
<tr>
<td>Frozen Products</td>
<td>0 to -20</td>
<td>-17 to -29</td>
<td>5 days, covered container</td>
</tr>
<tr>
<td>Fruits ***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apples, pears, citrus</td>
<td>50 - 70</td>
<td>10 - 20</td>
<td>2 weeks orig. container</td>
</tr>
<tr>
<td>Left over</td>
<td>36</td>
<td>2</td>
<td>2 days, covered container</td>
</tr>
<tr>
<td>Poultry</td>
<td>36</td>
<td>2</td>
<td>7 days, properly wrapped</td>
</tr>
<tr>
<td>Meat:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ground</td>
<td>38</td>
<td>3</td>
<td>2 days properly wrapped</td>
</tr>
<tr>
<td>fresh meat cuts</td>
<td>38</td>
<td>3</td>
<td>6 days, properly wrapped</td>
</tr>
<tr>
<td>Liver, variety meats</td>
<td>38</td>
<td>3</td>
<td>2 days properly wrapped</td>
</tr>
<tr>
<td>Cured bacon, Ham</td>
<td>38</td>
<td>3</td>
<td>1-4 weeks, wrapped</td>
</tr>
<tr>
<td>Dried Beef</td>
<td>38</td>
<td>3</td>
<td>6 weeks, wrapped</td>
</tr>
</tbody>
</table>

** Fruits that need ripening should not be refrigerated. Leave at room temperature until ripe, then refrigerate as above. The peels of ripened bananas and avocados get dark in refrigeration, but the flesh or pulp is not affected, as long as they are not bruised or skin in intact.
Step 4: Preparing

4 Safe Methods to Thaw Foods

1. Inside the refrigerator at the temp. of 41°F or below.
2. Under cold running water
3. In a microwave oven
4. As a part of cooking process

Guidelines for Pre-Preparation

Pre-preparation usually takes place at room temp., this stage is one of the most common points of contamination and cross contamination.

1. Wash hands correctly before preparing foods.
2. Don’t prepare in advance if it’s not necessary.
3. Prepare food in small batches and place them immediately inside the refrigerator
4. Wash fruits and vegetables prior to peeling and cooking
5. Keep raw products from ready to eat foods
6. Wash hands, sanitize cutting boards, knives after every food preparation
7. Use batter, marinade in single use only and discard if there are some left.
8. Use single use gloves properly

Step 5: Cooking

Guidelines for Cooking foods

1. Stir foods cooked in deep pots frequently to ensure even heat distribution
2. Avoid overloading fryers
3. Regulate uniform size and thickness of meat and vegetable to ensure even cooking.
5. Use clean and accurate thermometer to monitor internal temperature.
6. Always cook food to the required internal temperature and appropriate time
7. Use a serving utensil or single use glove to avoid cross contamination
8. Taste food correctly to avoid cross contamination. Place a small portion of food in a bowl and step away from the food. Taste it with a teaspoon. Wash hands before and after tasting the food.
# Cooking Requirements for Specific Food

<table>
<thead>
<tr>
<th>Product</th>
<th>Minimum Internal Cooking Temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry (whole &amp; ground)</td>
<td>165°F – 212°F for 15 seconds</td>
</tr>
<tr>
<td>Stuffing, Stuffed Meat</td>
<td>165°F 0°F for 15 seconds</td>
</tr>
<tr>
<td>Dishes combining raw &amp; cooked food</td>
<td>165°F for 15 seconds</td>
</tr>
<tr>
<td>Ground Meat (beef, pork, fish)</td>
<td>155°F for 15 seconds</td>
</tr>
<tr>
<td>Pork, Beef, Veal, Lamb</td>
<td>145°F for 15 seconds</td>
</tr>
<tr>
<td>Fish</td>
<td>145°F for 15 seconds</td>
</tr>
<tr>
<td>Shell Eggs</td>
<td>145°F for 15 seconds</td>
</tr>
</tbody>
</table>

## Step 6: Holding & Serving

### Holding Hot Food

#### Do’s
- Only use hot-holding equipment that can keep food hot all the time
- Stir food at regular intervals to distribute heat evenly
- Keep food covered.
- Check internal food temperatures at least every two hours using food thermometer
- Discard potentially hazardous food after four hours if it has not been held at or above 140°F
- Never mix freshly prepared food with food being held for service

#### Don’t
- Never use hot-hold equipment to reheat equipment to reheat food
- Never mix freshly prepared food with food being held for service.
Holding Cold Foods

**Do’s**
- Only use cold-holding equipment that can keep food at 41°F or lower.
- Check internal food temperatures at least every two hours.
- Protect food from contaminants with covers

**Don’t**
- Do not store food directly on ice. Place food in pans or plates first

Serving Food

**Do’s**
- Store serving utensils properly
- Use serving utensils with long handles
- Use clean and sanitized utensils for serving
- Practice good personal hygiene
- Minimize bare-hand contact with cooked and ready to eat food
- Handle glassware and dishes properly.
- Hold flatware and utensils by handles.
- Use plastic or metal scoops or tongs to get ice.
- Never use cloth meant for cleaning food spills for any other purpose.

**Don’t**
- Never stack glassware or dishes when serving.
- If possible, do not assign employees to more than one job during a shift

Step 7 & 8: Cooling & Reheating

- Food being cooled in the refrigerator should be loosely covered.
- Use shallow, pre-chilled pans (not more than 4 inches deep)
- Stainless steel container cool faster than plastic
- Use quick chill unit rather than refrigerator
- Pre-chill foods in a freezer for about 30 minutes before refrigerating.
- Never cool food at room temperature
- Reheat food only one time at a temp of 165°F for 15 seconds
- Never mix left over food with freshly cooked food
CHAPTER 6
PRINCIPLES OF HACCP SYSTEM
(HAZARD ANALYSIS CRITICAL CONTROL POINT)

Concepts:
HACCP (Hazard Analysis Critical Control Point) – A food safety system designed to keep food safe throughout it’s flow in an establishment.
Hazard Analysis – The process of identifying and evaluating potential hazards associated with food in order to determine what must be done.
Control Point (CP) - Any step in a food’s flow where physical, chemical or biological hazard can be controlled.
Critical Control Point (CCP) – The last step where you can intervene to prevent, eliminate, or reduce the growth of microorganism before food is served.
Critical Limit – A set range (minimum and maximum) limit a CCP must meet in order to prevent, eliminate, or reduce the hazard to an acceptable limit.
Monitoring – The process of analyzing whether your critical limit are being met.
Corrective Action – a pre determined step taken when food doesn’t meet a critical limit.
Verification – The last step where you verify or double check that the CCP and CL you selected are appropriate.

What is HACCP?
The HACCP system is based on the idea that if significant biological, chemical, or physical hazard are identified at specific points within the flow of food, they can be prevented, eliminated, or reduced to safe level.
A HACCP plan for a product prepared in one facility will be different from the HACCP plan for the same product prepared in another facility.

Pre-requisite Programs
Pre-requisite programs, also called Standard Operating Procedures (SOP)
1. Proper personal hygiene practices.
2. Proper facility design practices
3. Supplier selection
4. Cleaning & Sanitation program
5. Equipment maintenance program

HACCP Principles:
- Principles one, two, three help you design your system
- Principles four, five help you implement it.
- Principles six, seven help you maintain your system and help you very its effectiveness.
7 HACCP PRINCIPLES

Principle One: Conduct a Hazard Analysis

Things to consider in conducting a hazard analysis
- The ingredients used in the menu
- Equipment and processes
- Employees
- Customers
Identify any food that may become contaminated if handled incorrectly at any step in food service flow

Grouping of Food by Process
Prepare & Serve – example: Juices, sandwiches, green salad
Prepare, cook, serve – example: French fries, pizza
Prepare, cool, hold, serve – example: fruit salad
Prepare, cook, cool, hold, serve – example: gelatin, potato salad
Prepare, cook, hold, cool, reheat, serve – example: sauces, stew

Types of Hazard Could Occur in any point in a Food Service Process
1) Physical Hazard – foreign object (hair, nails)
2) Chemical Hazard – cleaning substances
3) Biological Hazard – any means microorganism grow and reproduce
   a. Time Temp. Abuse
   b. Poor Personal Hygiene
   c. Faulty Facility

Illustration of Hazard Analysis

Hazard could occur in any step like in preparation, hazard may include the following:
Cross contamination, time temperature abuse, in cooking may include the following hazard:
Inadequate cooking, faulty facility and more.
Principle 2 : Determine Critical Control Points

After identifying potential food hazards, the next step is to determine to intervene to control them. Consider the following guidelines:

- Any step in a food’s flow where physical, chemical, biological hazard can be controlled is a **control point (CP)**.
- To assess whether a control point is critical, you need to determine if it is the last step of controlling the hazard before the food is served to customers is called a **critical control point (CCP)**.
- Cooking, cooling or holding are typically CCP.

Ex. Determine the CP or CCP

<table>
<thead>
<tr>
<th>Item</th>
<th>Step of Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh chicken</td>
<td>Receive chicken at 41°F or lower (CP)</td>
</tr>
<tr>
<td>Fresh ground beef</td>
<td>Discard ground beef that has been in the temperature danger zone for more than 4 hours (CP)</td>
</tr>
<tr>
<td>Fresh Pork</td>
<td>Cook pork to a min. internal temp. of 140°F for 15 seconds (CCP)</td>
</tr>
<tr>
<td>Chili</td>
<td>Hold cooked chili for service at 140°F or higher (CCP)</td>
</tr>
</tbody>
</table>

Principle Three : Establish Critical Limits

When establishing critical limits keep in mind that they must be:

- Measurable (time, temperature)
- Based on scientific data such (FDA Food Code)
- Clear and easy to follow

Illustration of establishing a critical limit for cooking chicken

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RECEIVE -> STORE -> PREPARE -> COOK

41°F and below 32°F-41°F 45°F within 2 two hours 165°F-212°F for 15 seconds
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**Principle Four: Establish Monitor Procedures**

Monitoring lets you know that critical limits are being met, and that you are doing things right.

To develop a successful monitoring program, you need to focus on each CCP and establish clear directions that specify the following:

- **How to monitoring the CCP.** This depends on the critical limits you have established and might include measuring time, temperature, pH, oxygen, water activity.
- **When and how often to monitor the CCP.** Continuous monitoring is preferable but not always possible. Regular monitoring intervals should be determined based on the normal working condition in your establishment and depend on volume.
- **Who will monitor the CCP.** Assign responsibility to a specific employee or position and make sure that person is trained properly.
- **Equipment, materials or tools.** Food thermometer

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**MONITORING THE CCP**

After determining the critical control point for the chicken breast, and that the critical limit is 165°F for 15 seconds. Make sure that the critical limit is met by inserting a clean, sanitized, and calibrated thermometer into the thickest part of chicken breast. Make at least two readings in different locations in the breast, and the result will be recorded in a temperature log.
Principle Five: Identify Corrective Actions

Corrective actions are predetermined steps taken when food doesn’t meet a critical limit. Remember this is the last opportunity you have to ensure the safety of the food served. Corrective actions might include the following:
- Continuing to cook the food to the required minimum internal temperature
- Throwing food away after a specified amount of time
- Rejecting a shipment that is not received at the temperature you specified

Principle Six: Verify that the system works

After you have developed your HACCP system, you need to confirm that it works according to the plan. This is called verification.
- CCP or critical limits you have selected are appropriate
- Monitoring alerts you to hazards
- Corrective actions are adequate to prevent food borne illness from occurring
- Employees are following established procedures.
- Critical limits are frequently not being met
- Receive a food borne-illness complaint
- Your menu, equipment, processes, suppliers or products change

Principle Seven: Establish Procedures for Record Keeping and Documentation

Recording how food is handled as it flows through the establishment is important to the success of a HACCP system. Proper records allow you to:
- Document that you are continuously preparing and serving safe food
- Identify when your procedures should be modified due to food safety problems that have been noted.

SUMMARY

HACCP is a food safety system designed to keep food safe through its flow in an establishment. HACCP is based on the idea if the physical, biological, chemical hazards are identified at a specific points, hazards can be controlled and prevented.