

FOOD HANDLERS

— MANUAL • INSTRUCTOR —



Food and Agriculture Organization
of the United Nations



Pan American
Health
Organization



World Health
Organization
REGIONAL OFFICE THE
Americas

FOOD HANDLERS

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GRAPHIC DESIGN

SB Comunicação

ILLUSTRATIONS

Douglas Rosa de Carvalho

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Introduction

Food-borne diseases (FBDs) are one of the most frequent public health problems in daily life.

The hazards that cause FBD may occur in the different stages of the food chain (from primary production to the table). Independently from its origin, once the food reaches the consumer it may have an impact on public health and cause severe economic damage to the establishments devoted to its preparation and sale. These two events may cause loss of confidence and the closing down of a business.

Fortunately, the measures for preventing food contamination are very simple and may be applied by anyone who handles food, by following easy rules for hygienic food handling.

This Manual's purpose is to provide to people who handle food, and particularly to food-handlers' instructors, the information they need to facilitate the teaching of proper procedures to food workers. In addition, it seeks to provide basic information about food safety that Latin American and Caribbean countries may adapt to their own needs.

The Manual is organized into three Modules and Appendixes focusing on the following topics: (1) food hazards; (2) FBDs; and (3) hygienic measures to prevent food contamination.

The evaluation at the end, forms part of the Manual. Its purpose is to assess the knowledge learned during the course regarding the importance of hygienic food handling for public health.

Who is a food handler?

A food handler is anyone who handles packaged or unpackaged food directly as well as the equipment and utensils used to prepare or serve food and/or surfaces that come into contact with food. Food handlers are expected to meet food hygiene requirements (1).

Food handling is something that we all do daily, regardless of our occupation, whether we are cooking professionals, homemakers, or workers in a food plant. Therefore, there are many people who, through their effort and work, ensure that the food we consume on a daily basis is of sufficient hygienic quality that we can avoid the hazard of FBDs.

All of us have heard of diseases such as diarrhea and other kinds of gastrointestinal illnesses caused by the lack of food hygiene.

FBDs affect mainly the most susceptible segments of our society, namely, children, the elderly, pregnant women, and persons who are ill. About two-thirds of FBD epidemics have their origin in food consumption in restaurants, cafeterias, school dining rooms, and even at home.

If we always handle food with clean hands and follow the proper hygienic procedures, we can prevent our families, or our clients, from the risk of consuming contaminated food.

Our contribution as food handlers is critical in a food establishment and our work is of the utmost importance to our own health and the health of our family, our community, and the businesses where we prepare food.

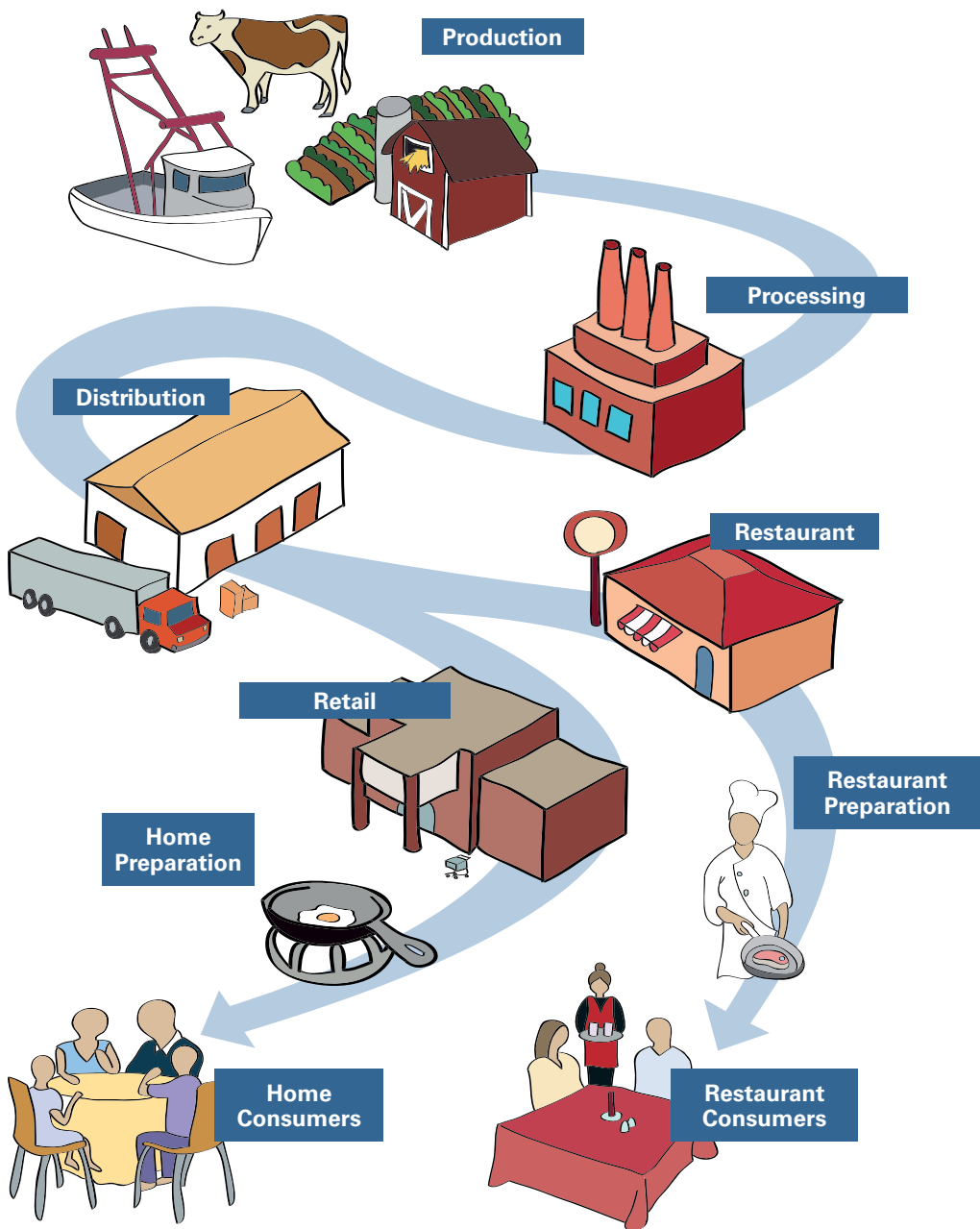


Food chain

The food chain extends from the farm, or primary production, to the final consumer (“from the farm to the table”) and includes processing, manufacturing, transformation, packaging, storage, transportation, distribution, and sale and/or provision of food products. At each of these stages, there is a responsibility to keep food under the same safety conditions and appropriateness until the moment of its consumption (2).

The main purpose of food hygiene is thus, to ensure all the necessary conditions and measures required to guarantee that food is safe and appropriate at all stages of the food chain to prevent food contamination and reduce the risk of acquiring food-borne diseases (1).

From the farm to the table





MODULE

1

FOOD HAZARDS

Definitions to be considered in this Module:

- 1. Hazards:** A biological, chemical, or physical agent in food, or a food condition that can have an adverse effect on health (1).
- 2. Contaminant:** Any biological or chemical agent, foreign matter, and other substances not intentionally added to food, which may compromise its safety and appropriateness (1).
- 3. Contamination:** Introduction or presence of a contaminant in food or in the food environment (1).
- 4. Food safety:** Assurance that the food will not cause the consumer any harm if prepared and/or consumed in accordance with the use for which it is intended (1).
- 5. Good Agricultural Practices (GAPs):** Application of all the necessary practices pertaining to the conditions and measures for ensuring the environmental, economic, and social sustainability of production, (and) of the processes subsequent to agricultural exploitation, to obtain food and agricultural products that are safe and wholesome (3).
- 6. Good Hygiene Practices (GHPs):** All practices pertaining to the necessary conditions and measures for ensuring food safety and appropriateness in all phases of the food chain (3).
- 7. Good Manufacturing Practices (GMPs):** Conformity with practice codes, norms, regulations, and legislation pertaining to the production, processing, handling, labeling, sale, transportation and distribution of food, issued by sectorial, local, state, national, and international bodies to protect the public from diseases, product adulteration, and fraud (3).
- 8. Food Ready to Eat (RTE):** Any food (including beverages) usually consumed raw, or any food that is handled, processed, mixed, cooked, or prepared in any other way, which is consumed without any further handling (4).

Food hazards

All along the food chain, food products are subjected to different preparation processes and conditions likely to contaminate them. Thus, utmost caution is required throughout the chain to ensure that food is not contaminated.

To prevent contamination, good agricultural practices (GAPs), good manufacturing practices (GMPs), and good hygiene practices (GHPs) must be applied to the entire food chain.

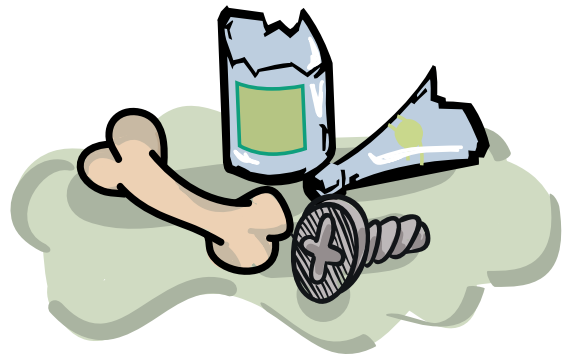
There are three types of hazards that can contaminate food and pose a threat to public health: physical, chemical and biological. They can be introduced accidentally, intentionally or criminally.

1. Physical hazards:

Associated with the presence of foreign matter in food. These hazards can cause injury by the consumption of contaminated foods.

Examples of physical hazards (5):

- Foreign matter, such as glass or wood fragments;
- Non-edible food parts, such as bone pieces or fruit stones.



2. Chemical hazards:

Chemical hazards occur when chemicals are present in food at levels that can be hazardous to humans and can occur along the entire food chain.

Examples include: residues of chemical products used on crops to control pests and during the transport, storage, and preparation of food. Toxic substances that may come into contact with food, such as pesticides, veterinary medicines, additives, fuel, lubricants, paints, detergents, and disinfectants.

Lastly, contamination may also occur on countertops and utensils, as these may have chemical substances on them at the time of food handling.

Examples of chemical hazards (5):

- Toxic substances that may occur in natural form (such as marine biotoxins, and mycotoxins);
- Environmental or industrial contaminants (such as mercury, lead, polychlorinated biphenyls (PCB), dioxin, radioactive nuclides);
- Residues of chemical products used in agriculture, such as pesticides, residues of veterinary medicine, and surface disinfectants;
- Toxic substances transmitted by the contact of food with the packaging or other materials;
- Other toxicology problems, such as allergies and endocrinal disorders caused by pesticide residues.



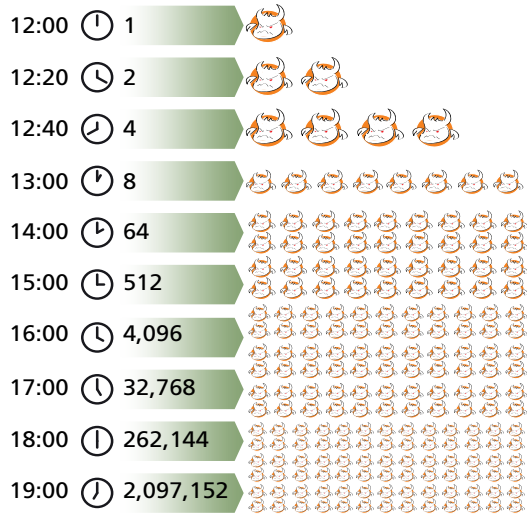
3. Biological hazards:

Include bacteria, parasites, and viruses.

The main hazards are microorganisms, which are living, microscopic beings found everywhere (in water, in air, in soil). According to their size, shape, and way of life, they can be classified as bacteria, yeasts, mold, viruses, and parasites. In general, bacteria and molds have the greatest impact on food safety (6).

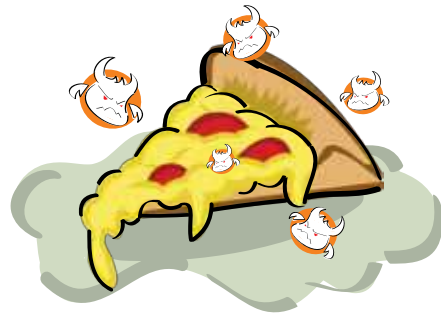


Bacteria are microorganisms with high reproductive capacity. In a few hours, they form groups or colonies of millions of bacteria, leading to food contamination. On average, under ideal conditions, bacteria may double in number every 20 minutes.



Examples of biological hazards (5):

- Zoonotic agents that may enter the food chain (Ex: *Brucella*, *Salmonella* spp, and prions);
- Pathogens transmitted through food (Ex: *Listeria monocytogenes*, *Trichinella*, *Toxoplasma*, *Campylobacter jejuni*, *Yersinia enterocolitica*);
- Pathogens resistant to anti-microbial agents (Ex: *Salmonella* Typhimurium DT 104);
- Other biological hazards of importance: *Staphylococcus aureus*, *Escherichia coli* 0157:H7, *Vibrio vulnificus*, *Clostridium perfringens*, *Clostridium botulinum*, *Bacillus cereus*, *Shigella*, the Hepatitis A virus; and parasites such as *Taenia solium*, *Taenia saginata*, *Anisakis simplex*, and related worms.



Where are microorganisms found?

Everywhere:

In the environment:

- In the air, soil, and water.
- On contaminated utensils.
- On contaminated food.
- In sewage.
- In garbage and food residues.

In human beings and animals:

- On human and animal skin.
- On infected wounds.
- On hair.
- On hands and nails.
- In human and animal saliva.
- In feces.



Types of food contamination: Primary, Direct, and Cross-contamination

1. Primary contamination:

Occurs in primary food production.

Example: Harvest, slaughter, milking, fishing.

A typical example is the contamination of eggs by the hen's feces.





2. Direct contamination:

The contaminants affect the food through the person that handles it. This type of contamination is probably the most simple and common form of food contamination.

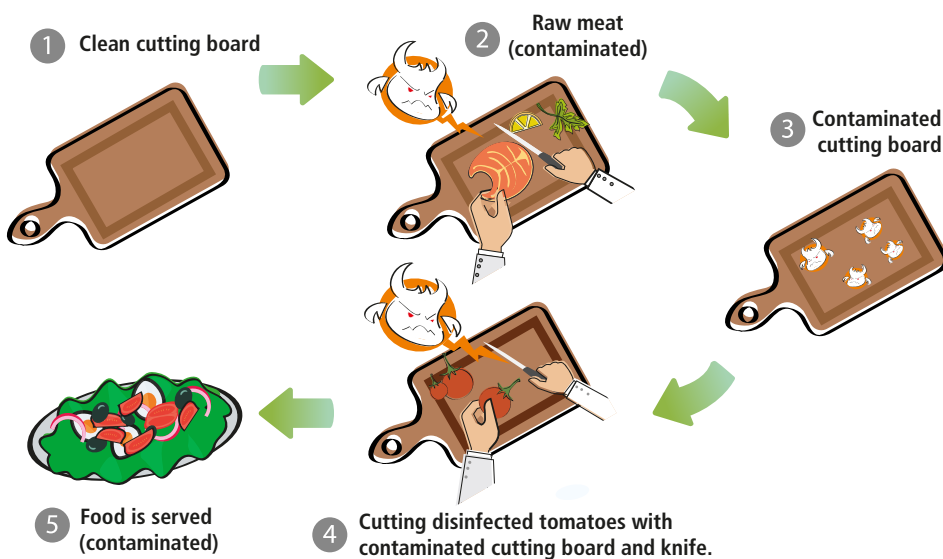
A typical example is when a person sneezes over the food.

3. Cross-contamination:

The contamination is caused by the transmission of a hazard present in a food to another food that is safe, via surfaces or utensils that have contact with both, without the requisite cleaning and disinfection.

The most frequent cases of cross-contamination occur when the handler allows a raw food to come into contact with a food ready to be consumed, by using the same cutting boards or kitchen utensils.

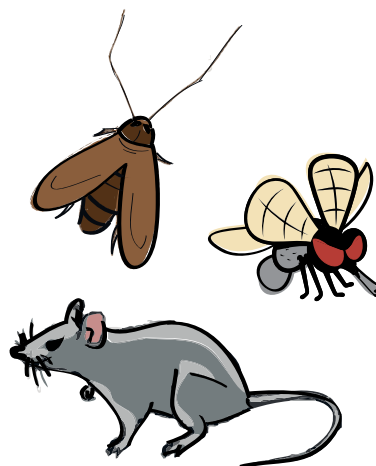
Another example of this type of contamination: when meat is grilled and the same cutting board is used for both raw and cooked meat.



Modes of food contamination

1. Vectors:

It is crucial to have a pest control programme where food is handled or processed. The main vectors implicated in food contamination are birds, flies, cockroaches, rats or mice, and ants. They carry microorganisms, which they deposit on food.



2. Garbage:

Where food is prepared or stored, garbage is an ideal culture environment for the development of microorganisms and the occurrence of pests.

Pest control program

It is recommended to contract a certified pest control service/company.

To prevent the proliferation of pests, the following steps should be taken:

1. Ensure that the facilities and equipment (building, furniture, windows) are properly maintained.
2. External environment should be well maintained.
3. Clean and disinfect the workplace frequently.
4. Store food correctly.
5. Proper disposal of leftover food at the workplace.

6. Prevent pests in the workplace by not leaving doors and windows open, installing mosquito screens and drain grates, among other measures.
7. Prevent animals from feeding on garbage and food residues.
8. Prevent pests from nesting in the workplace. This requires maintaining cleanliness and order at all times, including unseen spots, such as behind freezers.



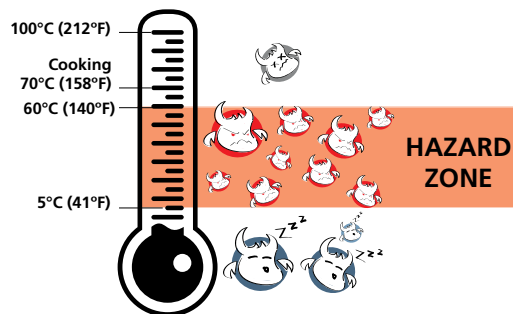
Favorable and unfavorable factors for microorganism reproduction

Factors that favor reproduction:

- **Nutrients:** Proteins. Foods rich in nutrients, such as milk, meat, cream, eggs and their byproducts have more propensity to contamination, as their high nutritional content, also provides food to microorganisms.
- **Water:** Indispensable to the life of bacteria. Foods such as milk, mayonnaise, and cream have a high mixture of water and nutrients.

- **Temperature:** Bacteria may be classified into psychrophilic (thriving at low temperatures), thermophilic (thriving at hot temperatures, between 50°C and 60°C, 122°F and 140°F), and mesophilic, according to their optimum reproduction temperature. Mesophilic bacteria reach their peak reproduction,

at temperatures close to human body temperature and we should thus take certain steps to prevent their multiplication.



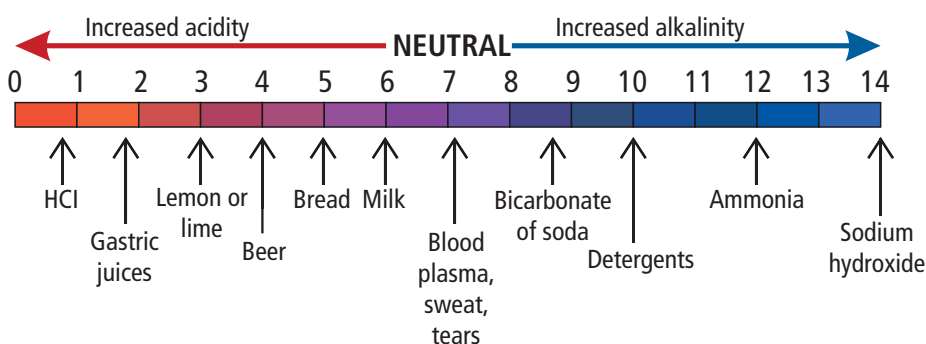
INSTRUCTOR

As a rule, temperatures below 5°C (41°F) can retard bacterial growth and multiplication. Temperatures between 60°C and 70°C (140°F and 158°F) their reproduction is meager or nil; Temperatures above 70°C (158°F) (proper cooking) ensure safe, wholesome foods.

- **Oxygen:** Most bacteria need air to survive, although some reproduce in environments without oxygen (anaerobic), such as large cuts of meat.
- **Time:** Under ideal conditions, bacteria can double their number in just 20 minutes.

Factors unfavorable to reproduction:

- **Acidity:** Bacteria grow easily on weakly acidic foods, such as most foods we prepare. Examples: fish, meat, chicken, etc.



- **Sugar:** Foods with high sugar content are unfavorable to the reproduction of microorganisms as sugar reduces the water available in the food. Examples: jams, jellies, etc.

- **Salt:** High salt content in food diminishes the water available for bacteria and are thus unfavorable for reproduction. Example: salted fish.



Table of foods with high potential hazard for microorganism contamination

HIGH POTENTIAL HAZARD
Cooked foods consumed cold or reheated.
Raw meat, fish, and shellfish.
Ground meat or stews.
Unpasteurized milk and dairy products.
Flans and desserts made with milk and eggs.
Whipped cream, custard sauce, and other sauces or creams.
Eggs and egg foods.
Cooked cereals and legumes, such as rice, lentils, and beans.
Cut melons and other weakly acidic fruit at room temperature.
Salad dressings with eggs.
Meat broth seasonings.
Soups and broths kept at high temperatures.
Broiled meat consumed promptly.
Fried foods consumed promptly.
Dried, salty foods, with natural or added acid, or preserved in sugar.
Walnuts, almonds, hazelnuts, if properly stored.
Breads, sweet cookies, or salads.
Butter, margarine, or edible oils.
Dry cereals.
Canned food until the can is open.
Cooked pasta.
Foods kept at a hazard temperature.

It is important to handle hazardous foods with care. Remember that these foods should not be kept in the hazard zone for more than two hours.



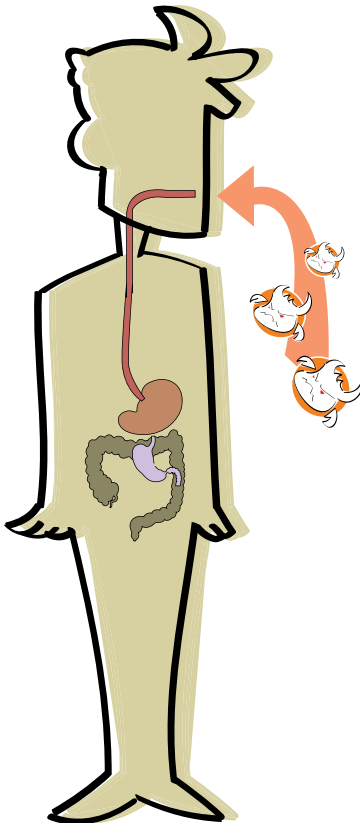
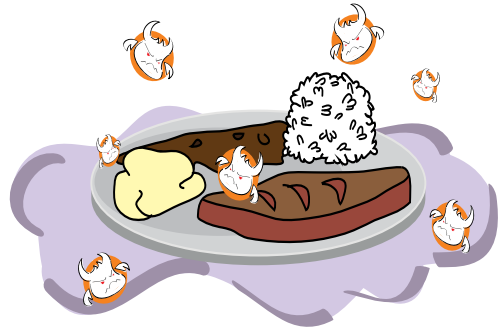
MODULE

2

FOOD-BORNE DISEASES

What are contaminated foods?

A contaminated food is a food that contains microorganisms such as bacteria, fungus, parasites, viruses, or toxins produced by microorganisms. A food may also be contaminated by the presence of foreign matter, such as soil, wood fragments, and hairs, or chemical contaminants, such as detergents, pesticides, or other chemical additives (7).



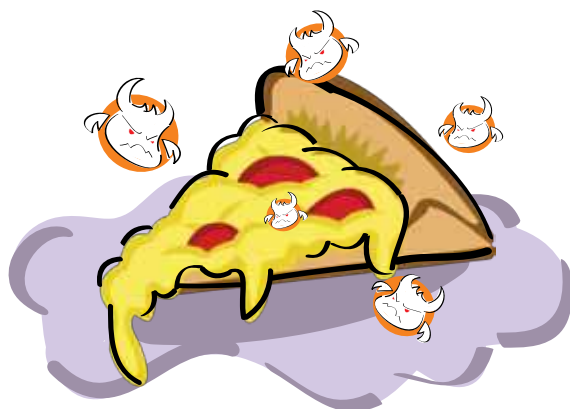
What are food-borne diseases? (FBDs)

Food-borne diseases are diseases of an infectious or toxic nature, caused by biological, chemical, or physical agents that enter the body using food as a vehicle (8).

Most common causes of food-borne diseases

Food borne diseases is an expression applied to all diseases acquired through the consumption of contaminated foods. The most common causes are intoxications, or poisoning, and infections (9).

1. Infection: occurs through the consumption of food contaminated with germs that cause disease, such as bacteria, viruses, larvae, or eggs of some parasites. An example would be bacteria such as Salmonella found in eggs, meat, chicken, dairy products, raw vegetables, and cut or peeled fruit (8).



2. Intoxication: Occurs through the consumption of food contaminated with chemical products, toxins produced by some germs, or toxins already present in the food (8).

Most common symptoms of food-borne diseases (FBDs)

The food-borne diseases described below do not always manifest themselves in the way indicated in this Manual, as the symptomology of a disease may vary according to different variables, such as the amount of food consumed, the individual's health condition, and the quantity of bacteria or toxin in the food, among others.

Independent from the disease and excluding the variables mentioned, the food-borne diseases tend to share the following symptoms:

- Stomach ache;
- Vomiting;
- Diarrhea; and
- Fever and headache.



Most common food-borne diseases (10)

Salmonellosis and Typhoid Fever

Agent	<i>Salmonella spp</i> (Gram-negative). There are two species of the <i>Salmonella</i> genus that may cause disease in humans: 1. <i>S. enterica</i> (the one of greatest concern for public health); and 2. <i>S. bongori</i>. Depending on the serotype, they may produce two kinds of disease: 1. Non-typhoid salmonellosis 2. Typhoid fever.
Mode of Transmission	Oral.
Incubation	Non-typhoid salmonellosis: 6 to 72 hours after exposure. Duration: 4 to 7 days. Typhoid fever: 1 to 3 weeks after exposure. Duration: up to 2 months.
Symptoms	1. Non-typhoid salmonellosis: Nausea, vomiting, abdominal cramps, diarrhea, fever, headache. 2. Typhoid fever: High fever, lethargy, gastrointestinal symptoms (abdominal pain and diarrhea), headache, muscle pains, loss of appetite. In some cases typhoid fever manifests itself by pink spots on the skin.
Foods involved	Raw meat, shellfish, eggs, uncooked dry fruit (and other dry foods), and fresh fruit and vegetables, among others. In general, typhoid fever is associated with contaminated residual waters, or crops irrigated with contaminated water.
Sources	Environmental sources of the microorganism include: water, soil, insects, plant and kitchen surfaces, and animal feces, among others. Other carriers of <i>Salmonella</i> are pets, such as reptiles, chicks and cats.
Control measures	1. Thorough cooking; 2. Proper personal hygiene e.g. washing hands; 3. Separation of raw foods from cooked foods; and 4. Keeping foods at the proper refrigeration temperature (5 C° (41°F) or less); 5. Prevention of cross contamination, sanitization of fruits and vegetables.

<i>Staphylococcus aureus</i>	
Agent	<i>Staphylococcus aureus</i> (Gram-positive).
Mode of Transmission	Consumption of foods contaminated with enterotoxins of <i>S. aureus</i> or ingestion of preformed enterotoxin.
Source	Humans.
Incubation time	1 to 7 hours after exposure (this varies according to the individual's susceptibility to the toxin, the amount of toxin ingested, and the individual's overall health). Duration: from a couple of hours to one day.
Symptoms	Nausea, abdominal cramps, vomiting, and diarrhea. In more serious cases, dehydration, headache, muscle cramps, and possible transitory blood pressure and pulse changes. Serious cases may require hospitalization.
Foods involved	Foods associated with this kind of food poisoning include meat and meat products, free-range fowl and eggs, salads, bakery products (cream-filled cakes, cream-filled and chocolate pastries), milk, and dairy products. Frequently, outbreaks are related to a high degree of handling during the processing and preparation of foods and/or lack of proper refrigeration.
Control measures	1. Wash raw fruit and vegetables, kitchen surfaces, utensils, and hands thoroughly; 2. Separate raw foods from cooked foods; 3. Cook foods according to manufacturer's instructions; 4. Refrigerate cooked food as soon as possible (including leftovers); 5. Use pasteurized milk; and 6. Proper personal hygiene and storage.

Enterocolitis caused by enteropathogenic <i>E. coli</i>	
Agent	<i>Escherichia coli</i> (Gram-negative).
Mode of Transmission	Oral.
Incubation	About 4 hours after exposure. Duration: 21 to 120 days.
Symptoms	Watery diarrhea, vomiting, and low grade fever
Foods involved	All foods and liquids contaminated with feces may transmit the disease. Example of the disease's transmission: A person infected with <i>E. coli</i> fails to wash their hands thoroughly after using the toilet and before handling food.
Control measures	1. Cool foods quickly; 2. Do not leave foods at room temperature; 3. Cook and warm food thoroughly; 4. Personal hygiene (bathing and hand washing); 5. Prevent cross-contamination; and 6. Protect water sources.
Further information	Two other kinds of <i>E. coli</i> may cause food-borne diseases. One of them Enterohemorrhagic <i>E. coli</i> , particularly <i>E. coli</i> O157:H7 causes serious harm to human health, such as kidney failure, among other complications.

Gastroenteritis caused by <i>Clostridium perfringens</i>	
Agent	<i>Clostridium perfringens</i> (Gram-positive) and its enterotoxins. This bacterium forms spores (heat resistant).
Mode of Transmission	Oral.
Incubation	About 16 hours after exposure. Duration: 12 hours to 2 weeks.
Symptoms	Watery diarrhea and abdominal cramps.
Foods involved	All foods that are not consumed or refrigerated right after being cooked are susceptible to contamination by <i>C. perfringens</i> . Meat and vegetables are the foods most commonly involved.
Control measures	1. Refrigerate foods immediately after cooking; 2. Wash fresh products properly; and 3. Proper reheating.
Further information	There is another type of disease caused by this bacterium, called "necrotizing enteritis". It is not very common but it is more serious and often fatal. Symptoms include abdominal pain and distension (with abdominal gases), diarrhea (at times with blood), and vomiting.

Botulism	
Agent	<i>Clostridium botulinum</i> (Gram-positive) and its neurotoxin. This bacterium forms spores (heat resistant).
Mode of Transmission	Oral.
Incubation	Usually 18 to 36 hours after exposure, but from 4 to 8 days has also been observed, depending on the amount of neurotoxin ingested. Duration: Weeks to months.
Symptoms	Adults: First symptoms may include double vision, blurred vision, drooping eyelids, difficulty talking and swallowing, dry mouth, and muscle weakness. If untreated, the disease may advance to paralysis of the arms, legs, trunk, and respiratory muscles. First signs of intoxication: lethargy, weakness, and vertigo, usually followed by double vision, and increasing difficulty in talking and swallowing. Difficulty in swallowing, excessive salivation, muscle weakness, abdominal distension, and constipation. Children: The first symptom is constipation, followed by blank facial expressions, poor feeding (weak nursing), weak crying, diminished movements, difficulty in swallowing, excessive dribbling, muscle weakness, and respiratory problems.
Foods involved	As the bacterium grows in places with little oxygen, the main foods involved are food in blown or bulging cans, canned food before sealing and food processed at home.
Control measures	1. Avoid contamination of raw materials from which food is prepared; 2. Avoid consuming home canned foods; and 3. Do not use food from blown, misshapen cans with bulging or rusty cans.

Gastroenteritis caused by *Bacillus cereus*

Agent	<i>Bacillus cereus</i> (Gram-positive) and its toxins. Two types of diseases may be caused by different <i>B. cereus</i> toxins. 1. Diarrhea; and 2. Vomiting. Keeping cooked food at warm temperatures for a long time allows the microorganism to reproduce and produce its toxins.
Mode of transmission	Oral.
Incubation	Diarrheic type: 6-15 hours after exposure. Emetic type: 30 minutes – 6 hours after exposure. Duration: 24 hours.
Symptoms	Diarrheic type: watery diarrhea and abdominal pain. The diarrhea may be accompanied by nausea, but vomiting rarely occurs. Emetic type: nausea and vomiting.
Foods involved	Rice and other foods rich in starch, cereals, meat and vegetables, and unpasteurized milk, cereals, among others.
Control measures	1. Wash hands; 2. Wash foods and utensils; and 3. Separate raw foods from cooked foods.
Further information	Cooking may kill the <i>Bacillus</i> but might not deactivate the toxin that causes the emetic disease.

Listeriosis

Agent	<i>Listeria monocytogenes</i> (Gram-positive). There are two types of disease in humans: 1. Noninvasive gastrointestinal disease, which usually resolves itself in healthy people. 2. Invasive disease, which may lead to septicemia and meningitis. <i>L. monocytogenes</i> tolerates salty environments and low temperatures (differently from other food-borne bacteria).
Mode of transmission	Oral.
Incubation	From a couple of hours to 2-3 days after exposure. In severe cases, incubation may take longer, from 3 days to 3 months. Duration: depends on the individual's health condition, and may last from a couple of days to several weeks.

CONTINUATION →

Symptoms	Healthy individuals may have mild symptoms, while others may have fever, muscle pains, nausea and vomiting, and diarrhea. When the more severe cases of infection occur and spread to the nervous system, symptoms may include headaches, stiff neck, confusion, loss of balance, and convulsions. Pregnant women may feel mild symptoms, similar to those of a cold. However, they may have miscarriages, and live births may have bacteremia, meningitis and could also lead to death.
Foods involved	Unpasteurized cheeses (particularly soft cheeses), unpasteurized milk, fish, cooked shrimp, smoked shellfish, meat, sausages, raw vegetables and ready to eat foods.
Control measures	1. Avoid consumption of unpasteurized milk and its byproducts (cheeses); 2. Cook foods thoroughly; 3. Wash raw vegetables thoroughly; 4. Reheat food thoroughly; 5. Avoid cross-contamination between raw foods and cooked foods; 6. Wash vegetables and fruit thoroughly; 7. Wash hands thoroughly; and 8. Proper storage temperature for ready to eat foods.

Campylobacteriosis

Agent	<i>Campylobacter jejuni</i> (Gram-negative).
Mode of transmission	Oral.
Incubation	Usually 2 to 5 days after eating. Duration: 2 to 10 days.
Symptoms	Main symptoms: fever, diarrhea, abdominal cramps, and vomiting. Other symptoms: abdominal pain, nausea, headache, and muscle pain. Feces may be liquid or sticky and contain blood (not always visible to the naked eye), and fecal leukocytes (white blood cells).
Foods involved	Raw poultry meat, unpasteurized milk, unpasteurized cheeses, and contaminated waters (creeks and lagoons). It may also occur in other types of meat, shellfish, and vegetables. Poultry products pose a significant hazard to consumers that handle fresh or processed birds improperly during preparation.
Control measures	1. Wash vegetables and fruit; 2. Clean kitchen surfaces and utensils; 3. Wash hands thoroughly; 4. Separate raw foods from cooked foods; 5. Cook foods according to manufacturer's instructions; 6. Refrigerate foods as soon as possible (including cooked leftovers); 7. Use only pasteurized milk.

Shigellosis

Agent	<i>Shigella</i> (Gram-negative)
Mode of transmission	The main mode of transmission is from person to person by the fecal-oral route. Infected individuals may propagate this pathogen in several ways, including through fingers, feces, flies, and fomites. With regards to food, contamination usually occurs because of a lack of hygiene on the part of the food handler.
Source	Humans.
Incubation	Usually, 8 to 50 hours after eating. Duration: 5 to 7 days.
Symptoms	May include abdominal pain, cramps, diarrhea, fever, vomiting, blood, pus, or mucous in feces, and painful defecation (effort in defecating).
Foods involved	Most shigellosis cases are due to the ingestion of foods or water contaminated by fecal matter. It is usually transmitted by foods eaten raw, such as lettuce, potatoes, tuna, shrimp, as well as by milk and dairy products, and free-range poultry.
Control measures	1. Wash hands thoroughly after using the toilet; 2. Cook foods properly; and 3. Proper personal hygiene.

Cholera

Agent	<i>Vibrio cholerae</i> serum groups O1 and O139 (Gram-negative).
Mode of transmission	Oral. Fecal-oral cycle.
Incubation	Usually, a couple of hours to 3 days after exposure. Duration: 5 to 7 days.
Symptoms	Usually, the disease starts with abdominal pain and diarrhea (which may vary from mild to severe). Vomiting in some cases.
Foods involved	Fish or shellfish from contaminated waters, contaminated drinking water, raw vegetables and salads irrigated or washed with contaminated water, or any food contaminated by remaining at a temperature that favors bacterial proliferation.
Control measures	1. Disinfect fruit and vegetables; 2. Cook foods properly; 3. Use potable water; 4. Wash hands, equipment, and cooking surfaces thoroughly before handling food; 5. Keep food refrigerated at 5°C (41°F) or less; and 6. Personal hygiene and wash hands.

Hepatitis A

Agent	Hepatitis A virus
Mode of transmission	Oral. Fecal-oral cycle.
Sources	Water contaminated with human faeces.
Incubation	Usually, 15 to 50 days. Duration: 1 to 2 weeks (in some patients, up to 6 months).
Symptoms	Fever, anorexia, nausea, vomiting, diarrhea, myalgia, hepatitis, and, often, jaundice
Foods involved	The most commonly associated foods are shellfish and salads.
Control measures	1. Wash hands thoroughly; 2. Always use potable water; 3. Avoid cross-contamination or direct contamination by the food handler; 4. Cook food properly at 88°C for at least 1½ minutes or boil food in water for at least 3 minutes.

Shellfish poisoning

Agent	Poisoning by shellfish is caused by a group of toxins produced by planktonic algae (most of them dinoflagellates), on which mollusks feed. Some cases of intoxication caused by these algae are: (1) Paralytic shellfish poisoning (PSP); (2) Diarrheal shellfish poisoning (DSP); (3) Neurotoxic shellfish poisoning (NSP); (4) Amnesic shellfish poisoning (ASP); and (5) Azaspiracid shellfish poisoning (AZP).
Mode of transmission	Oral.
Incubation	Usually, 30 minutes to 2 days after exposure (depending on the type of toxin).
Symptoms	Depends on the type of disease. Some may be fatal, such as paralytic poisoning, while others cause nausea, vomiting, diarrhea, and stomach ache, such as diarrheal and azaspiracid shellfish poisoning. There are other types of intoxication by shellfish, such as neurotoxic shellfish poisoning, whose symptoms are tingling on the lips and throat, dizziness, and muscle pains. In extreme cases, amnesic shellfish poisoning has led to serious neurologic disorders, such as short-term memory loss.
Foods involved	Shellfish, such as oysters, clams, and mussels, among others. In general, bivalve mollusks or snails contaminated with plankton where there has been proliferation of toxic algae.
Control measures	1. Rigorously abide by the shellfish fishing periods prohibited by the appropriate authorities; and 2. Pay attention to the shellfish programs in the country, industry orientation, and remain in close relations with regulators.
Further information	These poisons are not destroyed by cooking, refrigeration, freezing, or other forms of food preparation.

Other food-borne diseases

Taeniasis	
Agent	Caused by the swine <i>Taenia</i> (<i>Taenia solium</i>), or the bovine <i>Taenia</i> (<i>Taenia saginata</i>), or by the Asian <i>Taenia</i> (<i>Taenia asiatica</i>), platyhelminth parasites of the Cestoda class, which develop in the small intestine of human beings.
Mode of transmission	It enters the body through the mouth and moves directly to the intestine where it grows to one or two meters and lives for years. During this time, the eggs are transferred to the environment and are ingested by swine and cattle, thus giving continuity to the cycle.
Symptoms	Some people may not detect that they are infected, while others may suffer from, diarrhea, nausea, pain, and loss of appetite. The bovine <i>Taenia</i> may cause serious problems if the worm reaches the brain or other vital organs.
Foods involved	People may get infected with this type of <i>Taenia</i> by eating raw or undercooked pork, beef or wild game.
Source	Beef and pork meat, as well as vegetables contaminated with cattle, swine and human faeces.
Control measures	To avoid being infected with these worms (1) cook pork and beef at a minimum temperature of 63°C (145.4°F) for at least 3 minutes (in the center of the piece of meat); and (2) wash hands thoroughly before eating and after touching the ground.

<i>Anisakis simplex</i> and related worms	
Agent	Roundworms (nematodes).
Mode of transmission	They can be ingested alive in raw or lightly cooked fish, thus they may affect the stomach or the intestines.
Incubation	Symptoms start 24 hours to 2 weeks after exposure. The worm can live only about three weeks in human beings; then it dies, and is eliminated.
Symptoms	In some cases, one can only feel the worm sliding through the throat and, in other cases, when it sticks to the stomach or intestine wall, it causes stomach ache or abdominal pain, nausea, vomiting, and diarrhea. Sometimes it causes allergic reactions.
Foods involved	Common in fish, calamari, ink fish, and octopus.
Control measures	To prevent infection, fish should be cooked until the inside stays at 63°C (145.4°F) for at least 15 seconds, croquettes at 68°C (154.4°F), and stuffed fish at 74°C (165.2°F).
Source	Raw or undercooked seafood.

Trichinosis	
Agent	Caused by the parasite <i>Trichinella</i> spp (Nematode).
Mode of transmission	These worms' larvae, which live in the animal's skeletal muscle, infect other animals and human beings that consume these animals.
Source	<i>Trichinella spiralis</i> has been found in swine, wild boars, bears, and other animals. The disease it causes is highly significant for public health.
Incubation	7-30 days
Symptoms	At first, these parasites may cause mild symptoms, such as diarrhea, abdominal discomfort, nausea, and vomiting. When they reach the intestine, the worms mature and produce more larvae that travel to other parts of the body (liver, muscles, eyes, etc.); symptoms may appear 7 to 30 days after exposure, causing muscle pain, fever, weakness, and often, swelling around the eyes.
Foods involved	Rare meat, particularly pork and wild boar.
Control measures	1. Cook thoroughly pork and wild game, which may have the parasite; and 2. Make sure that the products to be consumed come from official establishments.

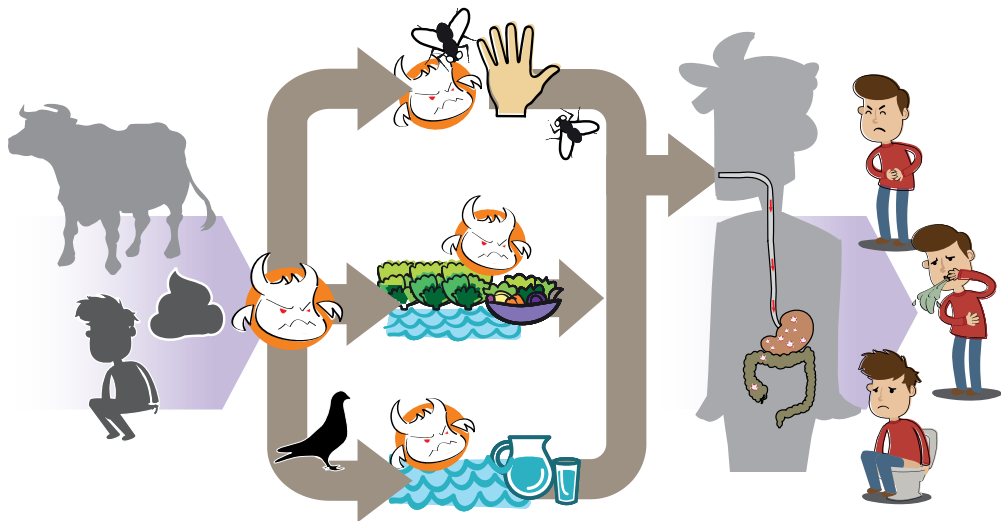
Aflatoxicosis	
Agent	Aflatoxins are mycotoxins produced by some fungi that grow on food. If consumed by animals and human beings, they may cause disease. The four main aflatoxins are AFB1, AFB2, AFG1, and AFG2, and are produced mainly by some strains of <i>Aspergillus flavus</i> and <i>Aspergillus parasiticus</i> .
Symptoms	Their major health effects are immunologic and hepatic problems, which may cause toxicity, as some aflatoxins are potent carcinogens.
Foods involved	The foods in which they are most commonly found are corn, sorghum, rice, cotton, peanuts, nuts, dry coconut meat, cocoa almonds, figs, ginger, and nutmeg.
Source	Contaminated cereals and grains.
Control measures	Store grains and cereals with adequate temperature and humidity.

Allergenic Foods	
According to the <i>Codex Alimentarius</i> "General Standard for the Labeling of Prepackaged Foods" (CODEX STAN 1-1985), the following foods and ingredients are known to cause hypersensitivity and should always be declared:	
• Cereals containing gluten; i.e., wheat, rye, barley, oats, spelt or their hybridized strains and their products; • Crustaceans and their products; • Eggs and egg products; • Fish and fish products; • Peanuts, soybeans and their products; • Milk and milk products (lactose included); • Tree nuts and nut products; and • Sulphites in concentrations of 10 mg/kg or more.	
Other known food allergens should be declared according to specific national regulations.	

Fecal-oral epidemiologic cycle mode of transmission

This cycle is one of the most common modes of transmission of pathogens to foods.

- 1. Short fecal-oral cycle:** It occurs when someone infected with a food-borne disease or a healthy carrier fails to wash hands after using the toilet and then handles food that is consumed by other people, who become sick afterwards.
- 2. Long fecal-oral cycle:** It occurs when fecal matter gets into water currents that are used to irrigate vegetables or fruit. If these, as well as hands, are not washed and disinfected thoroughly, the disease is caused by the ingestion of pathogenic bacteria.





MODULE

3

**Hygiene
Measures to
Prevent Food
Contamination**

Definitions for this Module:

1. **Food handler:** Any person that directly handles packaged or unpackaged foods, equipment and utensils used for food, or surfaces that come into contact with food and which are thus expected to meet the food hygiene requirements (1).
2. **Food safety:** Assurance that food will not cause harm to the consumer when it is prepared and/or consumed in a manner consistent with its intended use (1).
3. **Food appropriateness:** Assurance that foods are acceptable for human consumption, consistent with their intended use (1).
4. **Cleanliness:** Elimination of soil, food residues, dirt, grease, or other objectionable matters (1).
5. **Disinfection:** Reduction of the number of microorganisms in the environment, by means of chemical agents and/or physical methods, to a level that does not compromise the food's safety and appropriateness (1).
6. **Facility:** Any building or area where foods are handled, and its surroundings, under one management (1).
7. **Food hygiene:** All conditions and measures necessary to ensure the safety and appropriateness of food along the entire food chain (1).
8. **Altered food:** Food that for different reasons has suffered deterioration in its organoleptic characteristics (taste, smell, color, aspect, texture, etc.), composition, and/or nutritional value (7).
9. **Good manufacturing practices (GMPs):** Conformity with the practice codes, norms, regulations, and legislation pertaining to the production, processing, handling, labeling, and sale of food, issued by sectorial, local, state, national, and international bodies to protect the public from diseases, product adulteration, and fraud (3).
10. **Loss of food:** decrease in the mass of food destined for human consumption, observed in the production, post-harvest, and processing phases (11).

Conditions pertaining to the personnel that handle food:



Food handlers play a crucial role in reducing the likelihood of contamination of the products that they prepare.

At the personal level, the basic rules a food handler must observe are as follows:

- **Optimum health condition** : Free of respiratory problems, stomach illnesses, wounds, infection, or any other related conditions.

- **Personal hygiene:**

1. A food handler must wash his or her hands properly with running potable water and soap before handling food. The same procedure must be followed after any activity that is likely to contaminate one's hands;



2. A food handler should shower before going to work. A daily shower with plenty of water and soap should be part of his/her daily routine; and;
3. A food handler should keep his/her nails trimmed and clean, the face shaven or covered and groomed (in case of a male), and the hair washed and bound under a cap or a scarf.

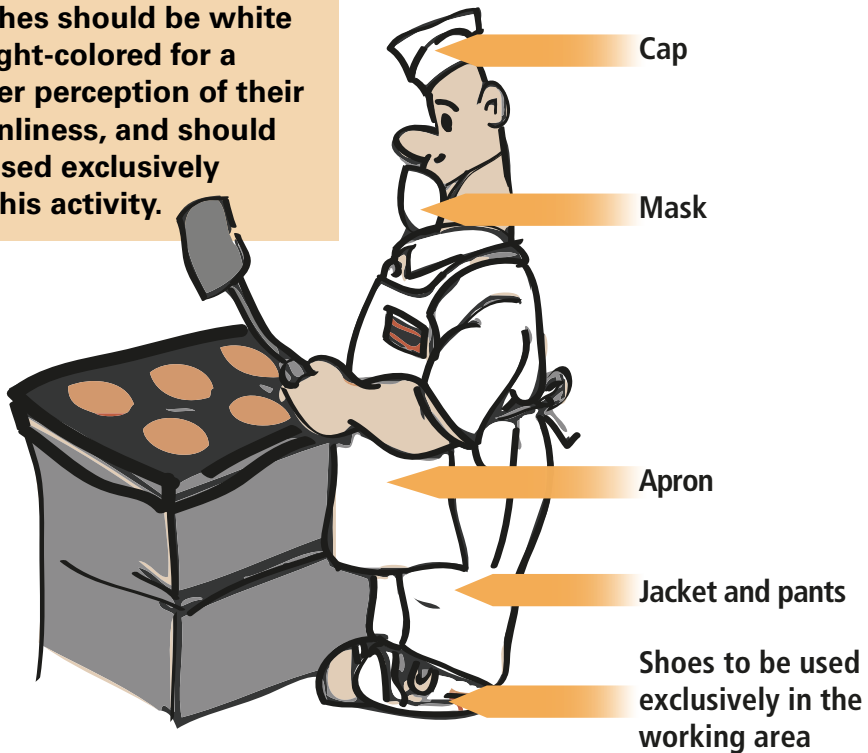


- **Clothing:** Clothes and jewellery can be a source of food contamination as they contain microbes and dirt collected during our daily activities. Therefore, jewellery should not be used by food handlers.

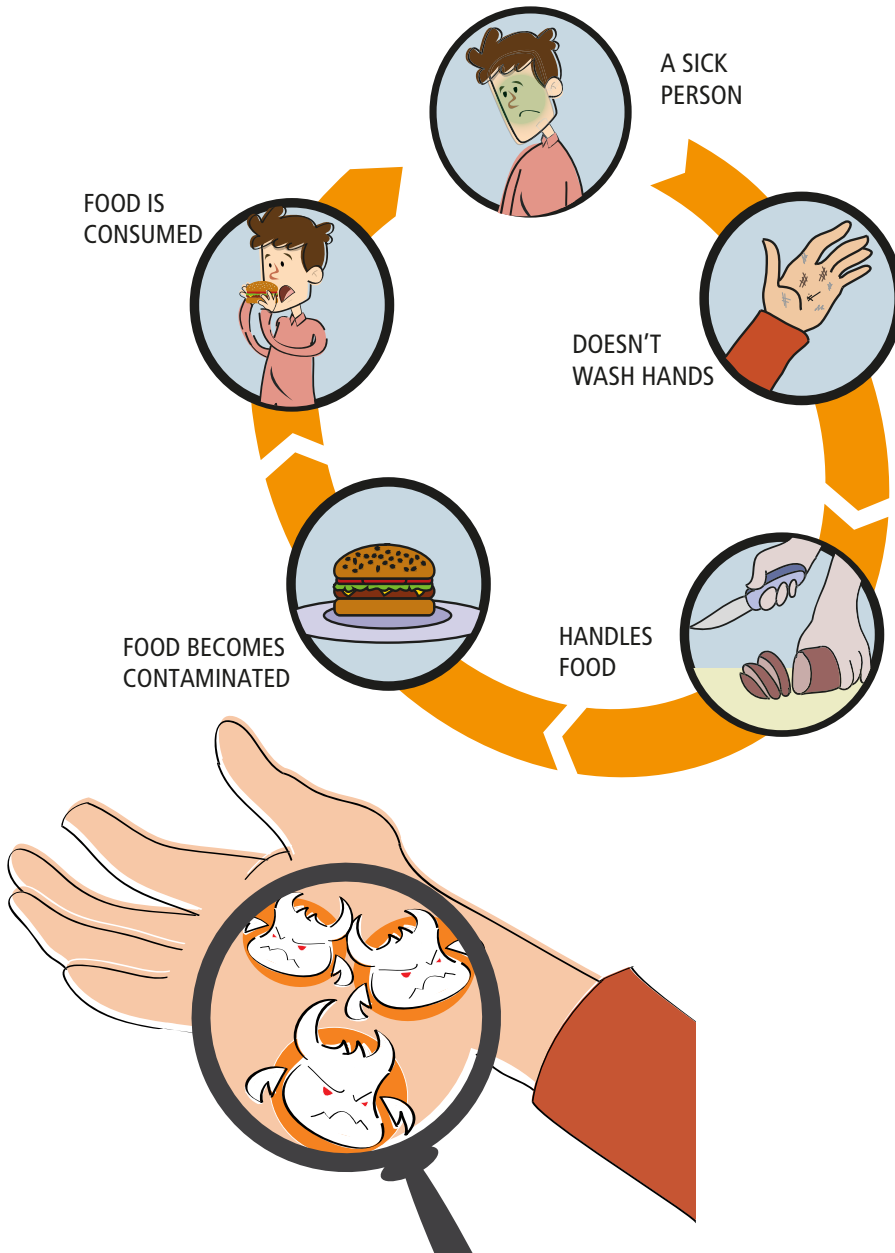
The following is a list of the appropriate clothing for a food handler:

1. A cap with proper hair restraint that covers the hair entirely to prevent hairs from falling.
2. A light-colored jacket, uniform, apron or garment worn solely in the work area.
3. A mask that covers the nose and mouth.
4. An apron.
5. Gloves.
6. Comfortable closed toe shoes to be worn exclusively in the work area.

Clothes should be white or light-colored for a better perception of their cleanliness, and should be used exclusively for this activity.

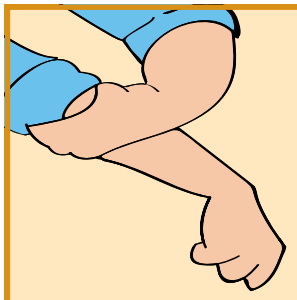


How can a disease be transmitted by unclean hands?



INSTRUCTOR

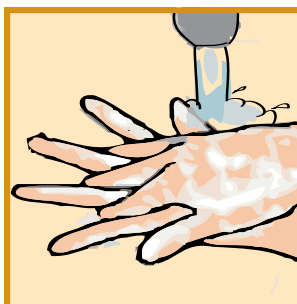
The correct way to wash hands in seven steps.



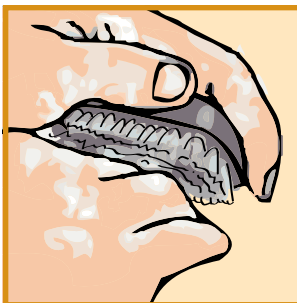
1
Pull sleeves up to the elbows.



2
Rinse hands and forearms.



3
Wash them thoroughly with soap.



4
Brush hands and nails.



5
Rinse with clean water to remove soap.



6
Dry, preferably with a paper towel or air.



7
Use a paper towel to turn off tap if not automatic or foot operated.

FOR FURTHER INFORMATION, SEE APPENDIX 1.

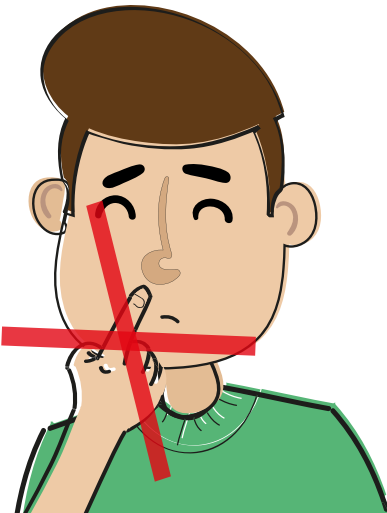
Food handlers' desirable and undesirable hygiene habits

Desirable habits

1. Thorough washing and sanitizing of utensils and preparation of surfaces before and after use.
2. Thorough washing of equipment and utensils before using them for serving food.
3. Always using soap and clean water.
4. Holding plates and serving dishes by the borders, silverware by the handle, and glasses by the bottom.



Undesirable habits



1. Cleaning or scratching nose, mouth, hair, ears, pimples, wounds, burns, etc.
2. Wearing rings, bracelets, earrings, watches, or other similar items.
3. Handling foods with hands instead of with utensils.
4. Using clothes as a cleaning or drying cloth.
5. Using the toilet while wearing protective clothes.
6. Smoking near food.

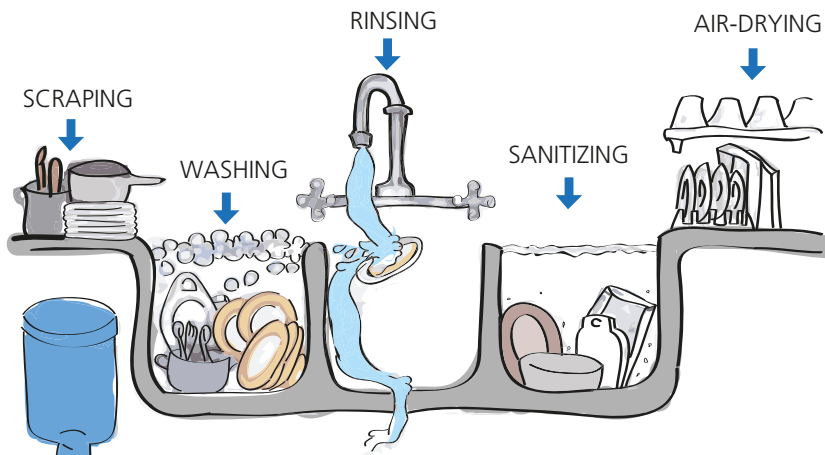
FOR FURTHER INFORMATION, SEE APPENDIX 7.

Hygienic handling of equipment and facilities

This is crucial for ensuring that our materials and workplace are not a source of food contamination.

Steps for proper washing of equipment and fixtures:

- Scrape solid residues.
- Use water and detergent for washing.
- Rinse with potable water (never reuse the same water).
- Sanitize by immersing in warm water with appropriate chemical sanitizer as required by each product's instructions.
- Air-dry (do not use rags).



Fixtures: counters, refrigerators, ham slicers, etc.

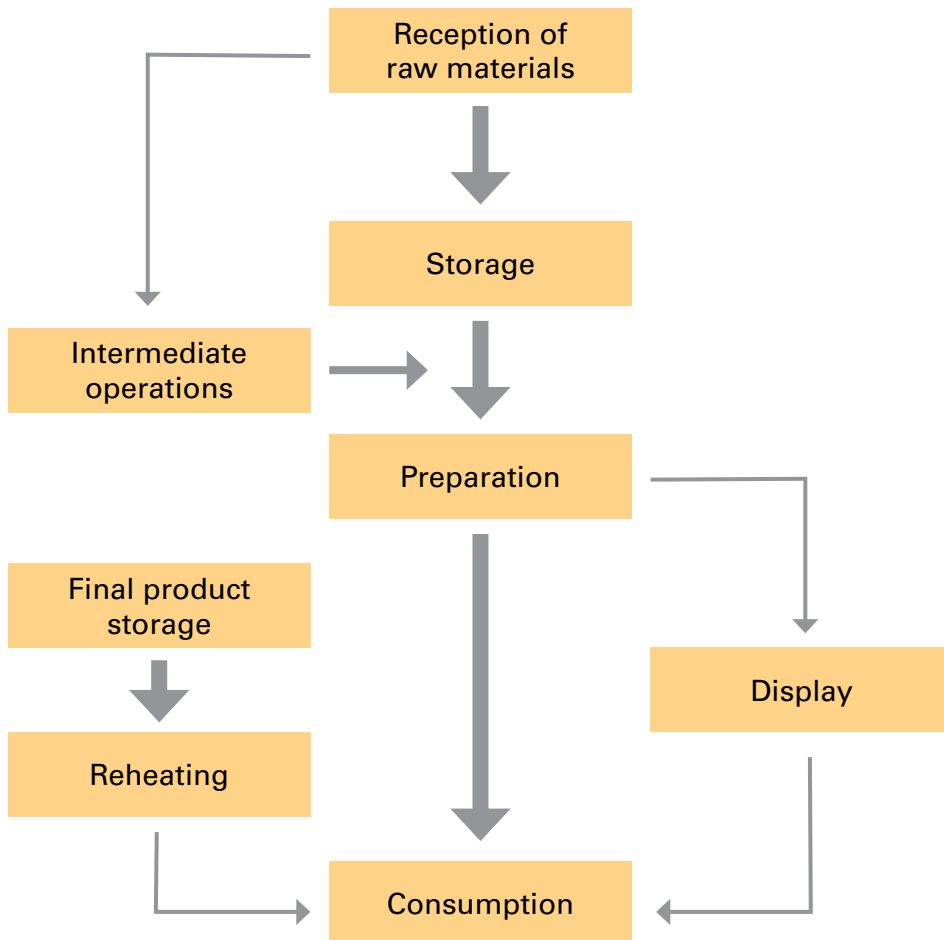
- Wash and sanitize several times a day according to use.

FOR FURTHER INFORMATION, SEE APPENDIX 2.

Hygienic handling of food during its preparation

For proper, hygienic handling of food, it is essential to apply Good Manufacturing Practices (GMPs) during the entire process of food preparation.

Food preparation encompasses the following processes:



Reception and handling of raw materials

The following points must be considered when receiving and handling foodstuffs:

1. Purchase from reputable suppliers.
2. Deliveries should be made at quieter times to allow proper inspection.
3. Plan the reception of products, ensuring that there is adequate space available for their storage.
4. Check that characteristics such as smell, color, taste and texture are proper for each type of product.
5. Check the foodstuffs' temperature at arrival to ensure that they meet the freezing, refrigeration, or heat requirements.
6. Immediately store foodstuffs in the appropriate places and at the temperature indicated for each type.
7. Avoid crowding refrigerators or freezers, as this reduces cold circulation and hampers their cleaning.
8. Raw foods should be kept in the lower parts and those that are ready to be consumed, or that require no cooking should be kept higher to prevent cross-contamination (this is because raw foods may liberate liquids that might fall on ready to eat foods).
9. Attention should be paid to the equipment's manufacturer's, food placement instructions.
10. Avoid storing great quantities of hot food in large containers, as this can raise the temperature inside the refrigerator and place other foods into their hazard zone.
11. All stored foods should be properly covered.

Food storage

Food storage depends on the type of food to be stored.

Foods that require no refrigeration or freezing should be stored in a place that is cool, dry, ventilated, clean, and at a distance of at least 15 cm (5.9 in) from the walls, ceiling, and ground level.

Shelves and platforms should be used to support raw materials.

All these measures help to prevent the occurrence of rodents and insects.



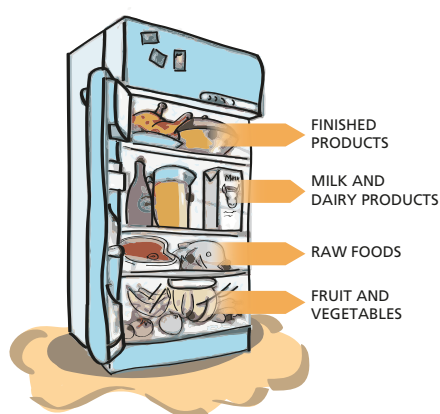
FOR FURTHER INFORMATION, SEE APPENDIX 3.

Rotation of raw materials

The proper rotation of raw materials is expressed by the “First In, First Out (FIFO)” principle; this is helped by recording the data for when each food was received or prepared.

The food handler will thus place foods with the nearest validity date closer, in front, or above those with a farther validity date.

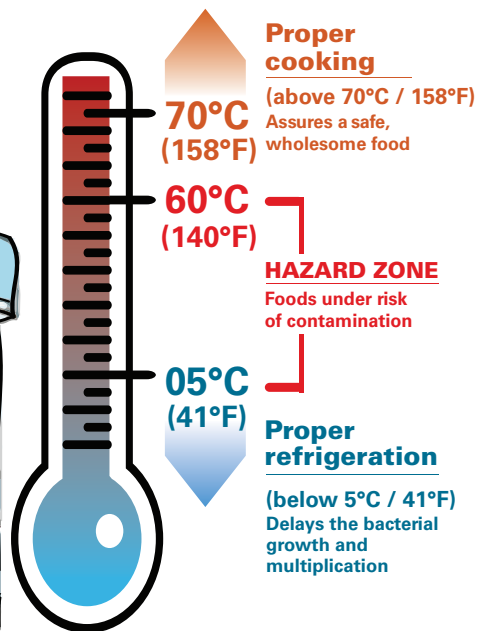
This allows for not only a proper rotation of products, but also for the discarding of products with an expired validity date.



Storage of foods

- In case there is only one refrigerator, it should be organized into sections according to the different inputs or uses.
- If there is more than one refrigerator, store raw foods in one, and already prepared foods in the other.
- Food containers should be covered and made of food-grade material.
- Store raw meat, poultry, seafood, or eggs in a way that their liquid will not drip onto ready to eat foods.
- Do not store open cans with their contents in the refrigerator; transfer contents to another container right after opening the can.

Further information:
A crowded refrigerator might not reach the proper temperature to conserve the food.



Storage of chemical products

This area should be used for the storage of chemical products which are used for the cleaning and disinfecting of work equipment and utensils, as well as the establishment's hygiene materials.

This section should thus be separated from the food storage area and kept very clean and orderly, with products labeled and, in some cases, kept under lock and key.

Empty food packaging should never be used for storing chemical products; neither should food be stored in empty packaging of chemical products. Confusion in this regard might lead to serious intoxication.



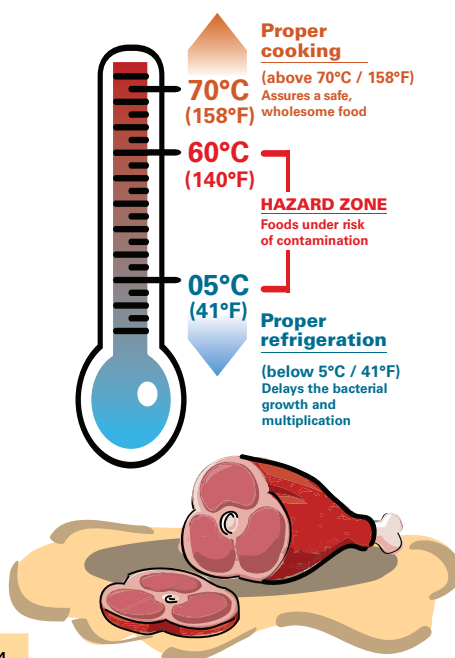
Food preparation: Control of operations subsequent to storage

Defrosting

Incompletely defrosted foods submitted to cooking run the risk of microbiologic contamination.

Such foods may seem cooked on the outside but remain raw in the center; bacteria in the center may thus survive.

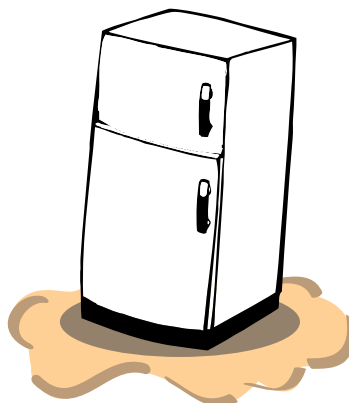
With the help of a thermometer, always ensure that the center of the food reaches the cooking temperature and is fully cooked.

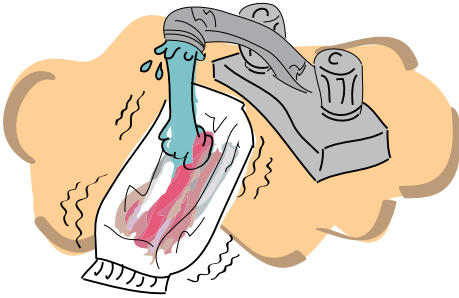


FOR FURTHER INFORMATION, SEE APPENDIX 4.

Safe methods for defrosting food include the following:

- **Refrigeration:** Once the products to be used have been chosen, they should be taken out of the freezer and placed in the lowest part of the refrigerator, so that defrosting is slow, at a temperature outside of the hazard zone.



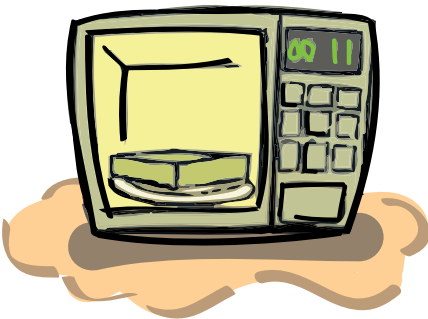


- **With potable water:** Running water over the food. The inconvenience of this method, particularly for large pieces, is that the defrosting time is long and allows the multiplication of bacteria on the surface which is exposed to room temperature, in addition to using a lot of water.

- **As part of cooking:** This method allows the food to reach the proper temperature with sufficient time to defrost the center of the food. This method is used for vegetables, hamburgers, and small meat portions.



- **In a microwave oven:** Given the microwave's high thermal efficiency, defrosting is efficient, but should be followed immediately by cooking.



Rapid cooling of food

Excessively deep containers in a refrigerator are unacceptable for fast cooling of potentially hazardous food. Plastic containers, even if shallow, are not recommended, either. Instead, steel containers 10-15 cm (3.94-5.91 in) high, with a lid, are recommended.



Remember that food should always be covered to avoid cross-contamination; but cold air should be allowed to circulate freely, so that the food will not reach hazardous zone temperatures.



Rapid cooling of food requirements

To prevent the reproduction of microorganisms in our food products, we must follow certain procedures to ensure fast cooling and the safety of our foods.

These procedures are as follows:

1. A pre-cooling stage to lower temperature from 75°C (167°F) or more to 60°C (140°F) in less than 30 minutes.
2. Reducing temperature from 60°C (140°F) or more to 21°C (69.8°F) in less than 2 hours.
3. Reducing temperature from 21°C (69.8°F) to 5°C (41°F) or less in another 2 hours, the whole process totaling 4 hours at the most.

Naturally, the establishment's preparation procedures should be adjusted accordingly, to ensure that this norm is strictly followed.

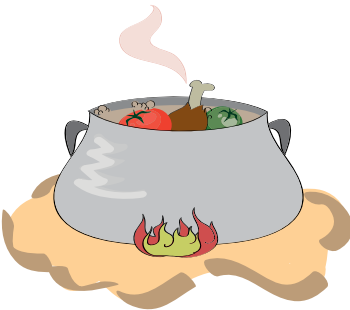
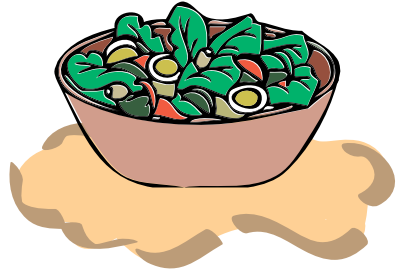
FOR FURTHER INFORMATION, SEE APPENDIX 5.

Handling some food groups

In most food establishments, a great variety of foods are prepared; it is thus essential to assign certain specifications to the different areas of the kitchen.

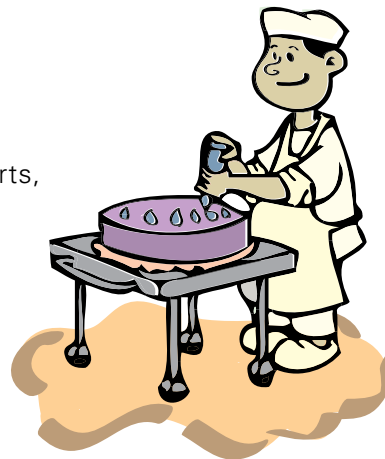
Food preparation takes place in three well-defined kitchen areas:

- **Cold kitchen:** This is where foods to be served cold are prepared. These encompass a wide variety of foods, including fruit and vegetable salads, cold meat entrees, sausages, dairy products, eggs, and seafood.



- **Hot kitchen:** where a great variety of dishes are prepared, usually based on meat, poultry, seafood, vegetables, pasta, sauces, and rice.

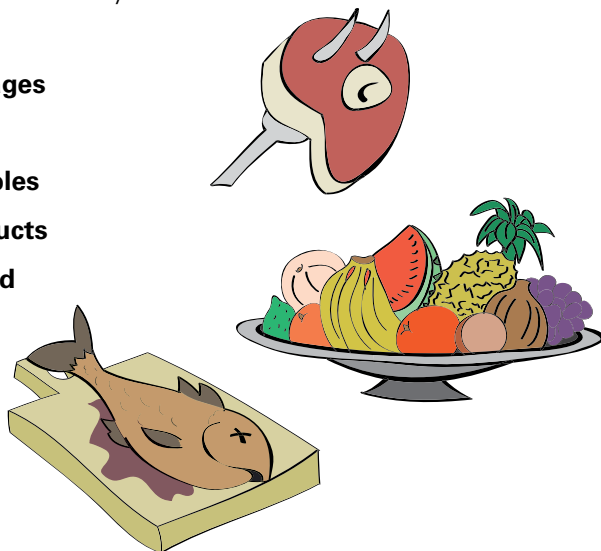
- **Bakery:** where cakes, breads, desserts, puddings, and pastries are prepared.



Owing to the diversity of perishable products handled in kitchens, it is necessary to organize these products to ensure their proper selection and handling. This means that all the personnel should be able to recognize the products' safety and quality.

Appendix 6 of this Manual demonstrates the proper handling of the foods most commonly prepared in kitchens.

- **Handling of meats and sausages**
- **Handling of fish products**
- **Handling of fruit and vegetables**
- **Handling of milk and byproducts**
- **Handling of confectionery and bakery products**
- **Water and ice**
- **Salads and dressings**



Visiting requirements

Visitors to places where food is prepared, particularly to processing areas, should be dressed the same way as has been recommended for food handlers; they should also comply with the same hygiene provisions indicated in this section.



Food contamination critical points

Food contamination critical points include procedure stages, locations, or operations where foods are more likely to suffer contamination or alteration.

By controlling these critical points, we can reduce the cases of food-borne diseases.

Critical points:

- Wash hands and utensils properly in preparation of handling food (never work with rusty utensils).
- Wash and disinfect utensils to be utilized.
- Wash hands before peeling or cutting food.
- Work on clean surfaces.
- Never mix food with hands (use proper utensils).
- At the final stages of food preparation, ensure that the proper temperature and cooking time are achieved.
- Keep food under refrigeration.
- Heat food to a minimum of 60°C (140°F) to eliminate microbes.
- Calculate the exact quantities to be used in a short period, thereby avoiding reheating and contaminating food.
- Pay attention to the time food is going to be at a temperature that favours bacteria multiplication.
- Serve food on clean utensils and correctly present it, while observing hygiene habits that are noticeable to consumers.
- Use proper disinfectant concentrations for cleaning and sanitizing food utensils.

Adulteration of Food

Food defense refers to the protection of food products from contamination or adulteration intended to cause harm to the public or economic disruption. Controls are necessary to prevent intentional adulteration from acts intended to cause wide-scale harm to public health, including acts of terrorism that target the food supply. Such acts, while not likely to occur, can cause illness, death, and economic disruption of the food supply in the absence of mitigation strategies. The focus of a food defense plan is not targeted at specific foods or hazards; it requires mitigation (risk-reducing) strategies for processes in food facilities, in order to prevent acts intended to cause wide-scale harm.

SUMMARY

Although nourishment is essential to human life, food can make one sick if it is not in optimum conditions for consumption.

To be considered appropriate, food must meet the following requirements:

- **Hygiene at all stages of the food chain.**
- **Proper organoleptic characteristics, (taste, smell, texture, and color).**
- **Absence of pathogenic microorganisms or their toxins.**
- **Free of chemical substances alien to its natural composition or which are not expressly permitted.**

Ill health may be caused by different reasons, including diseases that originate in, or are transmitted by food; these are known as food-borne diseases.

Food-borne diseases occur when we consume food contaminated with pathogenic microorganisms or their toxins (bacteria, parasites, fungi, and viruses). In many cases, these microbes reach the food through the food handlers themselves.

Food hygiene is concerned with activities that should ensure that foods meet the requirements of safety and wholesomeness, and keep their nutritional values.

Food workers and all individuals that one way or another handle food have an influence on the community's health. They have most of the responsibility for making sure that the food they prepare and serve is of an optimal condition for consumption.

Hygiene measures must be taken at each step of the operation, when choosing where to buy food, at its reception, for its proper storage, during its preparation, and afterwards, in the distribution, and delivery to consumers.

Hygienic habits, such as washing hands before handling food, not coughing or sneezing on it, and avoiding handling it with exposed wounds, help prevent food from being contaminated and affecting our health.



APPENDIX

APPENDIX 1

Five keys to food safety

APPENDIX 2

**Conditions in an establishment
where food is prepared**

APPENDIX 3

Food storage areas

APPENDIX 4

Thermometer, a food handler's instrument

APPENDIX 5

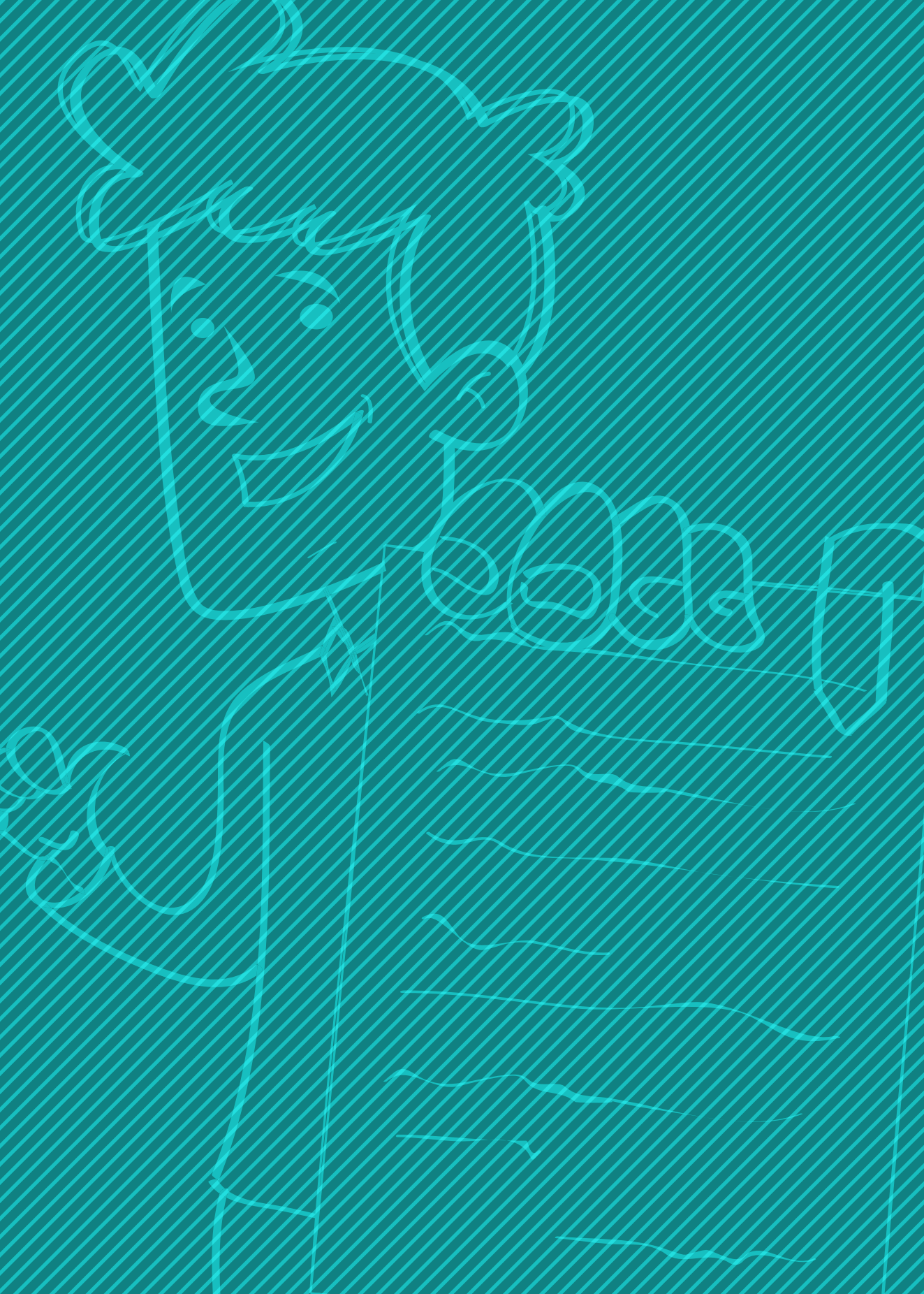
Procedures for rapid cooling of foods

APPENDIX 6

Handling of some food groups

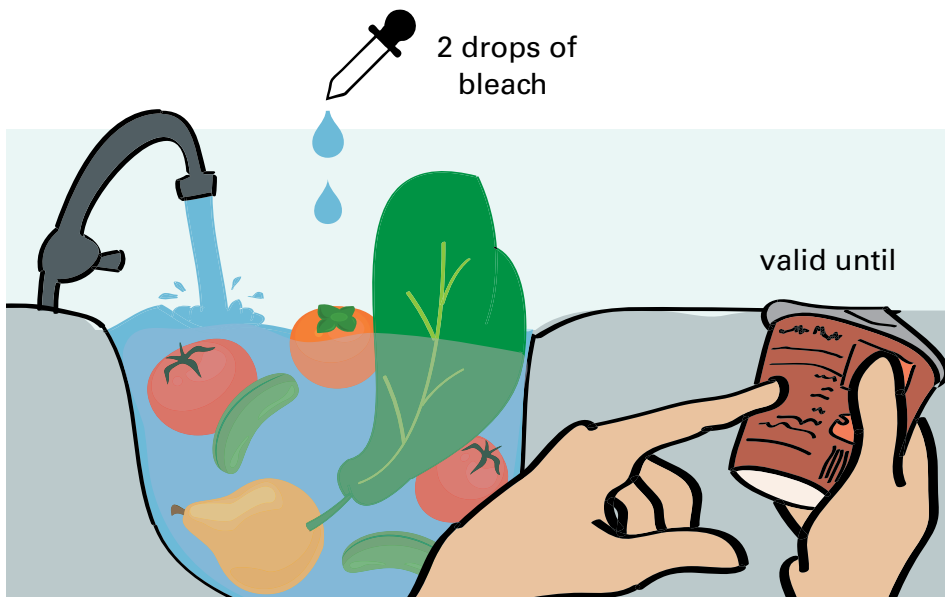
APPENDIX 7

***Eat Safely* Communication Campaign**



APPENDIX 1**Five keys to food safety (8)****Use safe water and raw materials**

All foods that are for consumption should come from reliable sources.



Use potable or treated water

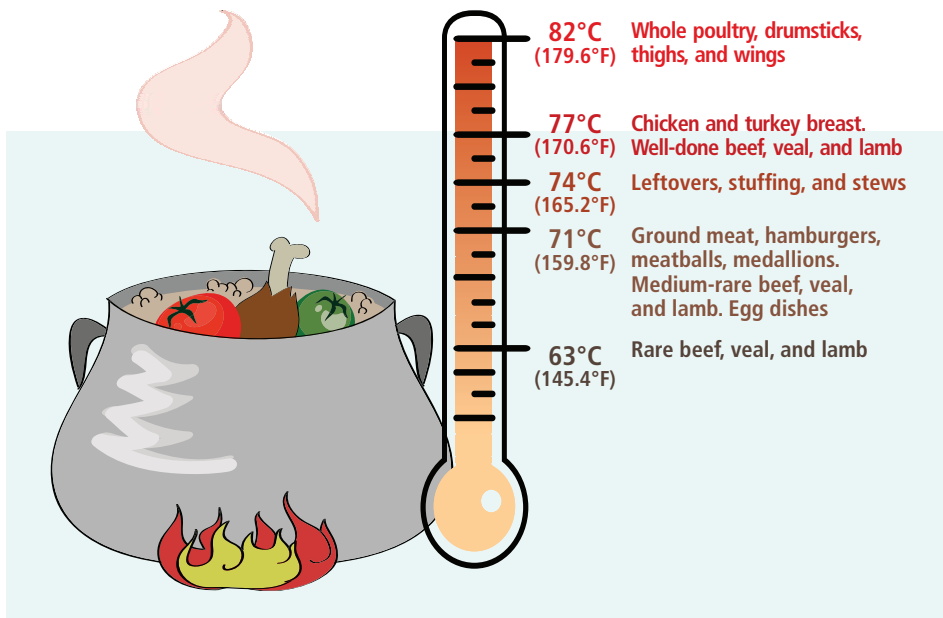
Choose processed foods

Wash fruits and vegetables

Check the expiration date and do not
consume foods with expired validity

Cook foods thoroughly

Cook foods thoroughly, especially meat, chicken, eggs, and fish.



Boil soups and stews to make sure they reach 70°C (158°F)

If cooking rare meat and chicken, make sure juices run clear, not pink

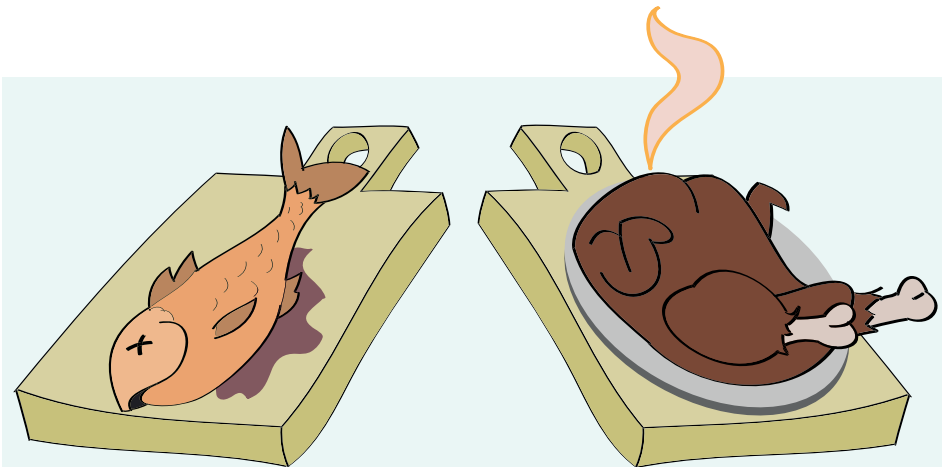
The use of a food thermometer is recommended

Fully reheat cooked food; make sure the center reaches 70°C (158°F)

Separate raw food from cooked food

Avoid cross-contamination!

Raw food may be contaminated with bacteria that migrate to cooked food or food ready for consumption.



Always keep raw food, such as chicken, meat, and fish, separate from cooked food and food ready for consumption

Maintain foodstuffs in separate containers to avoid contact between raw food and cooked food

Use different utensils, such as knives and cutting boards, when handling raw food and cooked food

How and when to wash hands?

Always wash your hands with warm water and soap, rubbing them well.



- Areas we often forget to wash
- Areas we sometimes forget to wash
- Areas we always remember to wash



Before

After

Eating

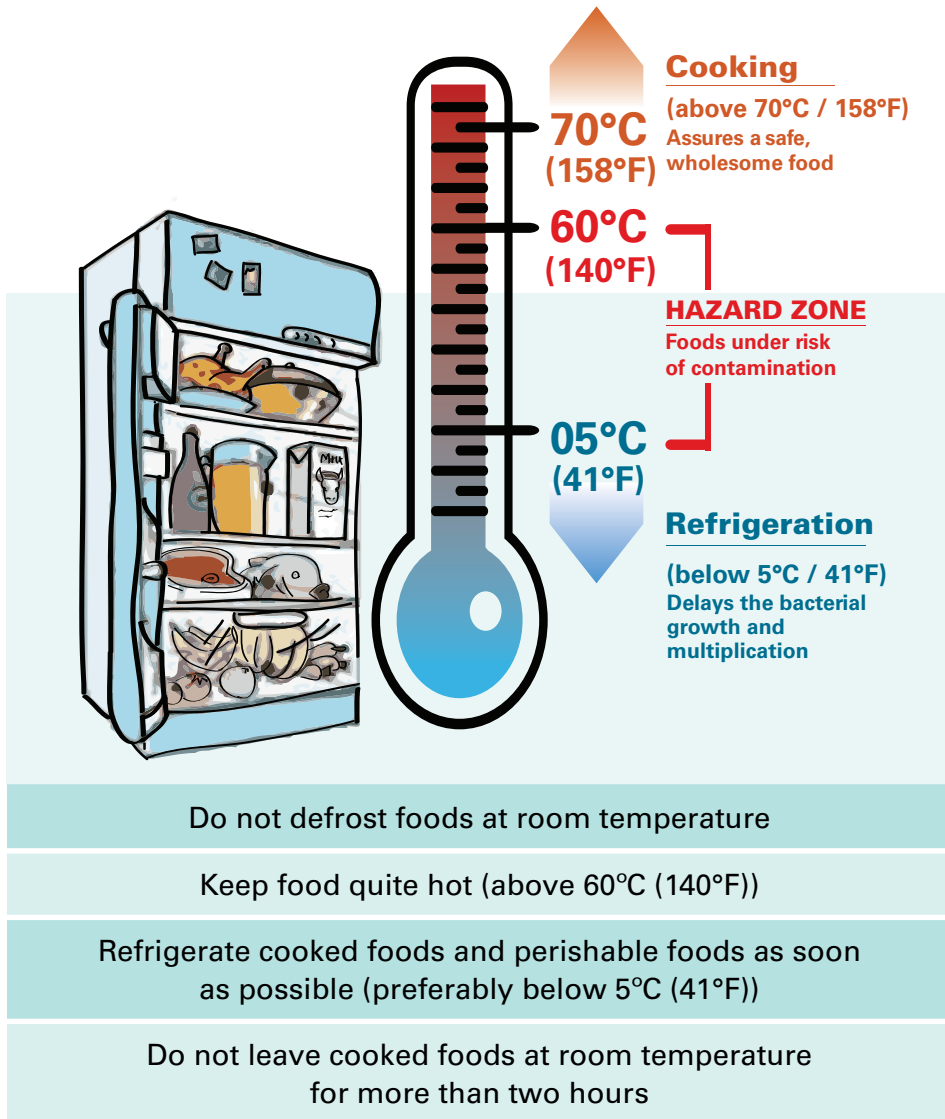
Using the toilet

Handling raw foods
(meat , fish, chicken, eggs)

Cooking

Playing in the park, touching pets
Blowing nose, sneezing, or coughing

Keep foods at the proper temperature



APPENDIX 2

Conditions in an establishment where food is prepared (8)

In an establishment where food is prepared, all necessary measures should be taken to decrease the probability of food contamination.

These measures are known as good manufacturing practices (GMPs) and should be known by every food handler.

Topics of interest

- **Location of the food preparation area and surroundings:** distant from garbage, sewage, places where toxic products are produced, and other contamination sources.
- **Design and hygiene of facilities:** A physical separation is desirable between the areas where raw materials are handled and those where food is prepared, and between hot kitchens and cold kitchens, for example. If physical separation is not possible, it should at least be functional. For example, working at different times on raw materials and on food preparation.
- **Construction materials:** All materials used for flooring, walls, and ceilings where food is prepared should be smooth and impermeable, easy to clean and disinfect, with no grooves, breaks, or designs conducive to the accumulation of dirt or bacteria.
- **Lighting and ventilation:** Lamps should be protected to prevent glass fragments from falling on foods in case of breakage.

Good ventilation is essential for controlling: 1. temperature, 2. dust, 3. smoke, and 4. excessive steam.

Doors and windows help ventilation and should be made of smooth, easy to clean materials; windows should have screens to prevent dust, insects, and other pests from entering.

- **Reception and storage areas:** These should be separated from the other areas, and be in good order, clean, and disinfected at all times.

Storage should be at a temperature appropriate for the stored raw materials to prevent bacterial reproduction.

- **Equipment washing and disinfecting areas:** Facilities should have both hot and cold water.
- **Processing or preparation area:** There should be a way for disposing of residues, sufficient room for the volume of production, hand-washing basin, equipment, and utensils, as well as windows that impede the passage of insects and other pests.
- **Serving or consumption area:** In this area, all equipment and surfaces must be clean and there should be screened windows that impede the passage of insects and other pests.
- **Personal services areas:** There should be exclusive toilets for the work personnel according to the number of employees. These toilets should be located where their ventilation can be turned to the outside, not toward the production area. There should also be exclusive toilets for the clients. Of course, there should also be exclusive toilets for the clients.
- **Quality water and ice supply:** There should be sufficient potable water for washing and preparing foods and for cleaning and disinfection. Ice should be made from potable water and handled with care.
- **Storage room for materials and equipment:** A storage room should be organized in such a way that an adequate amount of equipment and materials are immediately available, and to reduce the probability of pest infestation.
- **Cleaning and disinfection procedures:** This task is essential for the hygienic handling of food. Daily tasks include cleaning and disinfection of:
 - Processing areas (walls, floors, ceilings)
 - Surfaces that have contact with foods (tables, containers, utensils)

These procedures should be followed before and after food preparation, and often during the process also.

APPENDIX 3

Food storage areas (8)

1. Storage under refrigeration

High hazard foods should be kept at temperatures below 5°C (41°F) to prevent bacterial multiplication.

General keys:

- **Maintain proper air circulation.** Air temperature should be 4°C (39.2°F) (may be checked by a thermometer placed in the equipment's "warmest" area).
- **Avoid storing warm foods.** To prevent the equipment (refrigerator) from entering the hazard temperature zone. This can also happen when the equipment is crowded, as this prevents the cold air from circulating properly.
- **Protect foods.** Storing foods covered with aluminum foil or plastic in containers of the proper size is one of the best ways to prevent cross-contamination.
- **Check foods and equipment temperatures.** Monitoring of stored foods should take place at regular intervals and at random. Do not forget that the equipment's temperature should be checked often and that temperature readings should be recorded.

2. Frozen storage

Area where foods are stored frozen at below -18°C (-0.4°F); though this does not kill all microorganisms, it reduces their growth. In addition, frozen foods should be used as soon as possible within their validity periods.

General keys to be observed:

- **Store foods quickly:** A product that is not to be used immediately should be quickly put in the refrigerator.
- **Maintain the original packaging:** If necessary, the original packaging should be replaced by a container that protects its contents from humidity and keeps them clean and disinfected. Packages and containers should be properly labeled, with the identification of the contents, entry date, and a sale, consumption, or disposal date. This will help proper merchandise rotation.
- **Avoid crowding freezer:** Excessive loading of the freezer or storing hot foods in it, may raise the temperature and partially defrost stored foods.
- **Avoid refreezing:** In addition to affecting the food's quality, refreezing may facilitate bacterial multiplication, as the food releases liquids, which are nutrients. Also defrosting raises the foods outside temperature while the center remains frozen; this helps bacterial reproduction. Only if the food has been fully cooked should it be refrozen.
- **Rotate raw materials:** Application of the "First In, First Out (FIFO)" principle is recommended, according to the food's validity date.
- **Open door only if necessary:** Opening the door less often helps maintain the equipment's and the food's temperature. A good alternative is to program the food's storage and retrieval. Remember always to close the freezer door.
- **Check the temperature:** As for the refrigerator, the freezer's temperature should be checked at regular intervals with well-calibrated thermometers. Temperature readings should be recorded.

3. Dry storage

Dry and canned foods are stored in the dry storage area; these raw materials should be kept under proper temperature and humidity conditions, as heat and humidity are the most frequent problems in this kind of storage.

Room temperature should range between 10°C (50°F) and 21°C (69.8°F) and humidity between 50% and 60%; this may require dehumidifiers.

General keys:

- **Maintain original packaging:** This helps protect foods from any rodents, insects, or bacterial contamination. If taken out of its original packaging, food should be stored in tightly covered containers, that are protected and easy to clean.
- **Keep distances:** Food storage should be kept at a distance of at least 20 centimeters from the floors and/or the walls to facilitate the area's cleaning, contribute to better ventilation, separate foods from warm or humid walls, and give a better impression of the establishment.
- **Check temperature and humidity:** A thermometer and a humidity measurer (hygrometer) help to control the storage area's temperature and humidity conditions.

APPENDIX 4

Thermometer, a food handler's instrument

To be sure that food remains outside the hazard zone (5°C (41°F) to 60°C (140°F)), a thermometer should be used periodically to check temperatures, which should be recorded.

How to use the thermometer: Introduce it into the thickest part of the food and make sure it reaches the center. In the case of less thick pieces, such as a hamburger or a chicken breast filet, the thermometer may be introduced on the side.

There are different types of thermometers, such as the following:

- **Instant reading:** They are not designed to stay in the food during cooking. Temperature stabilizes in 15 to 20 seconds.
- **Digital:** They are not designed to stay in the food during cooking. Temperature stabilizes in 10 seconds. It is very appropriate for thinner products.
- **Ovenproof:** Designed for remaining in the food during cooking. It indicates the temperature as it rises.
- **Fork type:** Usually utilized in broiled foods.
- **Disposable:** Usually utilized in foods to be baked.

A thermometer must be calibrated every day. For this, it may be introduced into water with ice until the temperature stabilizes at 0°C (32°F). Otherwise, it will be necessary to move the nut to adjust it to 0°C (32°F).

APPENDIX 5

Procedures for rapid cooling of foods (8)

If possible, containers should not be more than 5-6 cm (1.96-2.36 in) deep, and the material should be stainless steel or aluminum, as they are more efficient in cooling the food. Plastic and other materials reduce the cooling process significantly.

Procedures should be as follows:

1. Divide large pieces into smaller ones and large portions into smaller portions. The size necessary depends on the equipment's cooling capacity; it is thus advisable to try until the ideal size is found.
2. Place hot food in previously cooled containers, and leave space between portions to allow better cold air circulation. The distribution of portions should avoid causing the accumulation of contents in the container's center.
3. Place containers with food, in bowls, with ice.
4. Stir food frequently (every 15 minutes). This will help to produce more uniform cooling of the food.
5. Stir the ice around the containers, to increase the procedure's efficiency.
6. Place containers in the refrigerator or freezer. At this stage, containers up to 12 cm (4.72 in) deep may be used. However, containers with foods such as soups, creams, or the like should not exceed 7-8 cm (2.75-3.14 in) in depth, while the depth of containers with thick preparations should not exceed 6 cm (2.36 in).
7. Foods covered (with aluminum foil or plastic, for example) slow down cooling. A third of the container may be left uncovered, but in some places, the rules require that they remain covered the whole time.

8. Measure the food's temperature with a sanitized thermometer to see if fast cooling is taking place (lower temperature from 60°C (140°F) or more to 21°C (69.8°F) in less than two hours, and from 21°C (69.8°F) to 5°C (40°F) or less in the next hours to reach a total of 4 hours).
9. If these temperatures and times are not attained, measures should be taken to correct the situation, such as the fast reheating of the food at 75°C (167°F) in the next two hours; or, if it is not to be served at this time, the food should be discarded.
10. These procedures may also apply in a freezer where there is no frozen food, as long as the equipment's efficiency ensures that the 4 hours for fast cooling are not exceeded.

APPENDIX 6

Handling of some food groups (8)

1. Meats and sausages

Among all the products prepared in a kitchen, beef, pork, and poultry occupy a significant place in regards to volumes prepared, as well as potential hazards.

So that the dishes prepared with meat may arrive to consumers in the requisite hygienic condition, it is consequently one of the most demanding raw materials in regards to its sanitary condition.

It is thus important to bear in mind some aspects pertaining to the sources of biological contamination of meats:

- Sanitary condition of slaughtered animals.
- Hygienic conditions for the transportation of animals prior to slaughter.
- Hygienic conditions at slaughtering.
- Proper refrigeration and maturation of carcasses or cuts.
- Hygienic conditions for the transport of carcasses or cuts in vehicles after slaughter.
- Proper storage and handling at the plant.
- Prevention of cross-contamination.

Defrosting meats

The optimum meat defrosting process should occur between 0°C (32°F) and 5°C (41°F), and slowly. However, for large pieces, defrosting may take too long, and this may cause a significant increase in the count of microorganisms.

An alternative is defrosting with water, which has the advantage of an intense temperature exchange. However, one should bear in mind that there is the possibility of cross-contamination when several pieces of meat are placed in the same water.

Defrosting in microwave ovens is another alternative, but unequal temperatures may occur owing to the diversity of pieces, especially in regards to their thickness. It may thus happen that when food is to be prepared, the defrosting of large pieces may not have been completed, and therefore, at the end of cooking, bacteria may survive in the center of the product.

Cuts of meats

Preparations based on meats, require the cutting of meat into smaller pieces; in some cases, cold plates consist of small pieces of different meats.

The fractioning of meats has three inevitable, important results as regards to bacterial growth:

- It increases the surface area exposed to contamination.
- It releases liquids rich in nutrients.
- It may entail contamination through utensils or cutting machines.

Usually, this phase favors microbial proliferation; thus it is necessary to ensure thorough cleaning and disinfection of equipment, utensils, and surfaces after each process.

Cutting raw foods and cooked foods with the same utensils should be avoided.

The preparation of meat cuts should be as quick as possible, with the elimination of the released juices, and followed immediately by storage.

Preparation of meats

Owing to its nutritional value, meat is a splendid substratum for bacterial growth. Special care is required in the application of proper, consistent temperatures during the thermic treatment, particularly in respect to very large pieces.

Poultry, stuffed meats, and other meat products should be cooked so that all parts of the food are cooked at a temperature of at least 71°C (159.8°F) without interruption.

Pork or pork products should be cooked until all parts of the food reach a temperature above 74°C (165.2°F).

Checking the temperature at intervals during the cooking of meats is essential when cooking takes more than one hour, as there is a greater possibility of the meats remaining in critical temperature zones.

Rolled pieces of meat should be prepared with more care than whole pieces, as there is the risk that the outside and the extremities of the cut will become more contaminated, while in the central part bacteria may survive more easily if the proper temperature is not reached.

Some establishments prepare large pieces of meat, which after a period of defrosting under refrigeration or at room temperature, are sliced for reheating.

This common practice is not advisable; it prolongs the time the meat remains at optimal temperatures for bacterial multiplication. Be this as it may, reheating should be done at a temperature above 74°C (165.2°F) (in the center of the piece).

When trays are prepared, whether with cold or hot dishes, one should rigorously control the temperature of the meats, as well as the time they remain at room temperature, bearing in mind the possibility of cross-contamination.

Meat sauces should be handled with care, as they have a high concentration of nutrients, so are a major source of contamination.

Lastly, minced meat dishes prepared during the day should be consumed the same day. Should reheating be inevitable, the entire dish should be heated at temperatures above 74°C (165.2°F) for at least two minutes.

2. Handling of fishery products

Fishery products are another important class of raw materials, as they are very susceptible to contamination by microorganisms.

As a rule, the main concern regarding the microbiologic quality of fish is the possibility of alterations that make it unsafe for consumption.

Fish and shellfish are highly perishable; their proper selection and conservation on ice throughout the process (transportation to the plant) are prime factors in maintaining their commercial life.

Once the product enters the plant, it is supremely important to check the transport and temperature conditions, as is the assessment of the desirable characteristics of smell, texture, and color of the fresh product.

Storage by freezing at -18°C (-0.4°F) has been shown to yield better results for these products. In fact, it has been found that frozen fish after being kept on ice for three days doubles its storage life without a loss of quality, as compared with only preserved fish on ice for nine days.

Defrosting procedures are similar to those recommended for meats, even in the case of small-sized items, which may be satisfactorily unfrozen in running water at a temperature no higher than 20°C (68°F).

Filleting

As in other handling operations, the worker's hygiene and the proper disinfection of knives, surfaces, and equipment are obviously important for preventing cross-contamination.

Preparation

The different varieties of fishery products are usually broiled; their cooking should reach a temperature of at least 65°C (149°F) throughout the portion; this is the case for fillets of the different species used.

After cooking at similar temperatures, crustaceans, shrimp, and crayfish are put under refrigeration for no longer than four hours. After this, the common practice is to peel them or take out the edible parts. This should be done as quickly as possible to maintain the refrigeration temperature, without forgetting the requisite hygiene measures to prevent their contamination.

3. Handling of fruit and vegetables

Horticultural products always have contaminants and may have a starting load of bacteria acquired from the soil and/or the water; leaves are more exposed to the air, while roots have more contact with the soil.

One of the greatest public health concerns regarding contamination of horticulture products is undoubtedly the presence of fecal matter in the irrigation water and/or in the soil, as these products may carry bacteria, viruses, or parasites.

Thus, the measures to limit or reduce the initial contamination and washing to reduce the microbial load are critical in controlling product quality. Control of

these critical points is very important for preventing the propagation of agents that cause disease in humans, including bacteria, parasites, and viruses, such as the hepatitis A virus.

Washing and disinfecting fruits and vegetables should be a strictly followed routine in the kitchen, as they are the raw material for the preparation of different dishes, many of which are consumed raw.

When handling leaf vegetables, the outside leaves, which contain dirt, should be eliminated and the remaining leaves should be washed with plenty of running potable water to get rid of the deeper dirt.

Disinfection should be achieved with chloric byproducts, such as hypochlorite solutions.

Hypochlorite is used for the immersion of already washed vegetables, in concentrations of 100-200 ppm for 15 minutes. This is equivalent to a soup spoon of hypochlorite solution to five liters of water. This is followed by vigorous rinsing. A longer time is not necessary, as leaves will wilt and acquire a hypochlorite taste.

4. Handling of milk and dairy products

Milk offers prime conditions for the multiplication of most bacteria. This food is very susceptible to contamination, starting from the time of milking.

The most utilized dairy products in the kitchen include milk, butter, hard cheeses, and cream. However, if these are properly selected and handled upon their arrival at the plant and during their processing, their use in different preparations should pose no major hazard.

5. Handling of bakery and confectionery products

The preparation of various products with ingredients that are highly susceptible to microbial contamination requires great care.

In fact, other than preparations based on flour used for bread and other bakery products, there are products that contain ground meat, such as pasties, pies,

and other products that require careful handling of the raw material to prevent cross-contamination.

Confectionery products include sensitive ingredients, such as cream, mayonnaise, eggs, and fruit, which require the careful selection of raw materials and handling under strict hygiene conditions.

The preparation of ground (minced) meat products requires the use of the best raw materials available, and to bear in mind that they have a very short life. Cooking times, their conservation warm or cold, as the case may be, and reheating before serving, are crucial points to be controlled with particular rigor.

As we have seen, desserts call for ingredients purchased from well-known suppliers and for extremely careful handling, particularly in regards to their conservation. For example, raw eggs should be properly washed in potable water with some disinfectant, as they are a source of contamination by the *Salmonella* bacterium, which is very frequently found on them.

In confectionery, the use of pastry bags and tips for decorating preparations with cream, is very frequent. These should be carefully washed and disinfected after use; otherwise, they pose a serious contamination hazard.

Keeping these products under refrigeration as needed requires control of the temperature and time; these are crucial points of interest.

Some canned products, particularly fruit, are also used in confectionery; as they are industrially processed, they offer little hazard. Some fresh fruit, however, used for decoration, present a greater contamination risk and should thus be washed and disinfected.

6. Water and ice

Water and ice are much used in food services and, as seen before, both must meet the requirements for potable water.

Today, treated, bottled waters for consumption are a reliable quality alternative when the water supply network is not available or when there is a lack of control of tanks and pipes. One must make sure that bottled water suppliers are well known and trusted in the community.

Ice is usually packaged in plastic bags or appropriate containers. However, one must always bear in mind that it can be a source of contamination.

7. Salads and dressings

Preparations of these kinds of foods nearly always contain eggs or egg byproducts, such as mayonnaise. Under no circumstances should one use raw eggs, as they may be contaminated with the *Salmonella* bacterium. For this reason, the preparation of mayonnaise in food establishments is not highly recommended; it is preferable to use the industrial product.

APPENDIX 7

Eat Safely Campaign

Eat Safely is a communication campaign promoted by the Food Safety and Quality Team of FAO's Regional Office for Latin America and the Caribbean.

Its aim is to show in a simple and direct manner some basic precautions to be taken when handling and preparing food, to ensure safe, healthy eating, thus contributing to the achievement of one of FAO's regional priorities: to promote food safety and quality.

For the *Eat Safely* campaign, audio and printed material, such as folders and posters have been produced, as well as T-shirts and comic strips.



FOR MORE INFORMATION, VISIT
THE FAO PAGE INDICATED IN
REFERENCED LITERATURE.

REFERENCES

1. General Principles of Food Hygiene, CAC/RCP 1-1969. In: Codex Alimentarius: international food standards. 2003.
2. Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). Ministerio de Salud y Consumo de España. Sistemas de Calidad e inocuidad de los alimentos. Capítulo 2: Higiene de los alimentos y buenas practicas. Roma, 2002. Available from: <ftp://ftp.fao.org/docrep/fao/005/w8088s/w8088s00.pdf>
3. Food and Agriculture Organization of the United Nations (FAO). Food Safety Risk Analysis: A guide for national food safety authorities. Rome; 2006. (FAO Food and Nutrition Paper, 87). Available from: <http://www.fao.org/docrep/012/a0822e/a0822e00.htm>
4. Food and Agriculture Organization of the United Nations (FAO). Recommended International Code of Practice. General Principles of Food Hygiene. Section II. Scope, use and definition. In: Joint FAO/WHO Food Standards Programme Codex Alimentarius Commission. General Requirements (Food Hygiene). Codex Alimentarius (Supplement to Volume 1B). Rome; 1997. Available from: <http://www.fao.org/docrep/005/Y1579E/y1579e00.htm>
5. Food and Agriculture Organization of the United Nations (FAO). FAO's Strategy for a Food Chain Approach to Food Safety and Quality: A framework document for the development of future strategic direction. In: 17th Session; Rome, 31 March-4 April 2003. Available from: <http://www.fao.org/docrep/MEETING/006/Y8350e.htm>
6. Food and Agriculture Organization of the United Nations (FAO). Buenas prácticas de higiene en la preparación y venta de los alimentos en la vía publica en América Latina y el Caribe. Herramientas para la capacitación. Rome; 2009. Available from: <http://www.fao.org/alc/file/media/pubs/2009/higiene.pdf>
7. Food and Agriculture Organization of the United Nations (FAO). Educación en alimentación y nutrición para la enseñanza básica. Módulo 4: Alimentos sanos y seguros. Santiago; 2003. Available from: <http://www.fao.org/docrep/014/am401s/am401s00.htm>
8. Pan-American Health Organization (PAHO). Manual de capacitación para manipuladores de alimentos. Available from: <http://publicaciones.ops.org.ar/publicaciones/piezas%20comunicacionales/cdmanipulacion%20alimentos/manipuladoresmanualintro.htm>

9. Gutiérrez G. Estudio de caso – Enfermedades transmitidas por alimentos en Nicaragua. In: Organización de las Naciones Unidas para la Alimentación y la Agricultura (FAO). Enfermedades transmitidas por alimentos y su impacto socioeconómico: estudios de caso en Costa Rica, El Salvador, Guatemala, Honduras y Nicaragua. Rome: FAO; 2009. (FAO. Informe Técnico sobre Ingeniería Agrícola y Alimentaria, 6). Available from: <http://www.fao.org/3/a-i0480s/i0480s06.pdf>
10. Food and Drug Administration (FDA). Bad bug book, foodborne pathogenic microorganisms and natural toxins. 2. ed. New Hampshire; 2012. Available from: <http://www.fda.gov/Food/FoodborneIllnessContaminants/CausesOfIllnessBadBugBook/>
11. Food and Agriculture Organization of the United Nations (FAO). Panorama de la seguridad alimentaria y nutricional en América Latina y el Caribe, 2014. Roma; 2014. Available from: <http://www.fao.org/3/a-i4018s.pdf>
12. World Health Organization. Five keys to safer food manual, 2006. Available from: http://www.who.int/foodsafety/publications/consumer/manual_keys.pdf

For further information, visit our pages:

Food and Agriculture Organization of the United Nations (FAO):
<http://www.fao.org/home/en/>

World Health Organization (WHO): <http://www.who.int/en/>

Pan American Health Organization (PAHO): <http://www.paho.org/hq/index.php>

Eat Safely campaign: <http://www.fao.org/americas/recursos/come-sano/en/>



FINAL EVALUATION

FINAL EVALUATION

Introduction

The final evaluation of food handlers is meant to assess the knowledge they have acquired during the course.

The evaluation consists of two parts:

Part 1

Multiple choice and true-and-false questions (justify FALSE answers) and;

Part 2

Figure 1: "What is wrong in this picture";

Figure 2: Look at these images and group them based on the hazard they represent and identify which are the vectors of biological hazards.

The first part accounts for **26 points**, the second, for **34 points**. Each correct answer counts for one point. Thus, **60 points** will be necessary for 100% approval. Points will not be discounted for wrong answers.

Please read each question carefully before answering.
Good luck!

PART I:

Final evaluation after FAO/PAHO-WHO course for food handlers.

01. A food handler is “anyone that directly handles food, packaged or not, equipment, and utensils used for food, or surfaces that may have contact with food; it is thus expected that a food handler meets all food hygiene requirements”.

☒ True

☐ False

If you marked False, explain why the statement is false:

02. There are three types of food contamination hazards, which may entail a public health hazard: (1) physical hazards, (2) biological hazards, and (3) chemical hazards.

☒ True

☐ False

If you marked False, explain why the statement is false:

03. Chemical hazards include the following example(s):

- I. Natural toxic substances.
- II. Industrial and environmental contaminants.
- III. Agricultural residues.
- IV. Glass fragments.
- V. Toxic substances that pass from the packaging to the food.

Answer:

- (1) Only I
- (2) Only II
- (3) I, II and IV
- (4) I, II, III, and V
- (5) All of the above

04. Bacteria are the microorganisms that have the greatest impact on food safety, as they have an optimum reproduction capacity, which allows them to form groups of colonies of millions of bacteria in just a few hours, giving origin to the contamination. On average, under ideal conditions, bacteria double in number every 20 minutes.

☒ True

☐ False

If you marked False, explain why the statement is false:

05. Biological hazards may be found.

- I. In the air.
- II. In infected wounds.
- III. In flies, cockroaches, and rodents.
- IV. On the skin of animals.
- V. In contaminated utensils.

Answer:

- (1) Only I
- (2) Only II
- (3) I, II and IV
- (4) I, II, IV and V
- (5) All of the above

06. Which of these answers are examples of sources of contamination:

- I. Sneezing over food.
- II. Touching food while having wounds on the hands.
- III. Vectors (example: flies, cockroaches) on the food.
- IV. Egg contaminated with hen feces.

Answer:

- (1) Only I
- (2) Only II
- (3) I, II and IV
- (4) I, II, IV and V
- (5) All of the above.

07. Indicate if the following statement is true: "While preparing a barbecue one may use a wooden cutting table for serving raw food and then use the same cutting table for cutting cooked food."

- ☐ True
- ☒ False

If you marked False, explain why the statement is false: The same cutting table should never be used for cutting both raw and cooked foods.

This could cause cross-contamination.

08. Indicate which of the foods listed below are at great risk of contamination:

- I. Cooked foods to be consumed cold or reheated.
- II. Raw meats, fish, and shellfish.
- III. Ground meat or meat stew.
- IV. Unpasteurized milk and dairy products.
- V. Canned food before the can has been opened.

Answer:

- (1) Only I
- (2) Only III
- (3) I, III and IV
- (4) I, II, III, and IV
- (5) All of the above.

09. Which factors favor microorganism reproduction:

- I. Nutrients.
- II. Salt.
- III. Water.
- IV. Time.
- V. Temperature.

Answer:

- (1) Only I
- (2) Only III
- (3) I, III and IV
- (4) I, III, IV and V
- (5) All of the above.

10. Good manufacturing practices (GMPs) do not include practices meant to protect the public from diseases, product adulteration, or fraud.

- ☐ True
- ☒ False

If you marked False, explain why the statement is false: GMPs are meant to protect the public from diseases, adulteration, and fraud.

11. Food intoxication, or poisoning, and infection are two of the most common causes of food-borne diseases. Infections are caused by food contaminated with germs that cause disease, such as bacteria, larvae, or eggs of some parasites.

☒ True

☐ False

If you marked False, explain why the statement is false:

12. As the last link in the food chain, consumers are not responsible for ensuring food safety.

☐ True

☒ False

If you marked False, explain why the statement is false: [Responsibility for ensuring food quality encompasses the entire food chain, including from the farm to the final consumer.](#)

13. In light of your knowledge about food-borne diseases, indicate if the following statement is correct: "At events where there are great quantities of food, there is less probability of contamination, the prevention of which is only possible if good hygiene practices are applied to food handling"

☐ True

☒ False

If you marked False, explain why the statement is false: [At events where there are great quantities of food, the probability of food-borne diseases increases. One way of controlling food-borne diseases is through GMPs.](#)

14. Independently from the disease, food-borne diseases tend to have the following symptoms in common:

- I. Stomach ache
- II. Vomiting
- III. Diarrhea

Answer:

- (1) Only I
- (2) Only II
- (3) Only III
- (4) I and III
- (5) All of the above.

15. The basic rules a food handler must follow at work are the following:

- I. Optimum health condition.
- II. Personal hygiene (proper washing of hands, showering before going to work, trimmed and clean nails, etc.).
- III. Proper clothing.

Answer:

- (1) Only I
- (2) Only II
- (3) Only III
- (4) I and III
- (5) All of the above.

16. Which of the habits listed below are desirable in food handlers?.

- I. Cleaning or scratching nose, mouth, hair, ears, pimples, wounds, burns, etc.
- II. Wearing rings, bracelets, earrings, watches, or other similar items.
- III. Handling foods with the hands instead of with utensils.
- IV. Using clean water and soap.
- V. Wearing pieces of clothing to use as a rag to clean or dry.

Answer:

- (1) Only I
- (2) Only III
- (3) Only IV
- (4) III and IV
- (5) All of the above.

17. Indicate if the following statement is true: “The storage place for products that do not require refrigeration or freezing should be cool, dry, ventilated, clean, and separated from walls, ceiling, and ground level by at least 15 cm (5.9 in).”

☒ True

☐ False

If you marked False, explain why the statement is false:

18. The proper rotation of raw materials consists in applying the First In, First Out (FIFO) principle. This may be helped by writing on each product the date it was received or the food was prepared.

☒ True

☐ False

If you marked False, explain why the statement is false:

19. A crowded refrigerator will more easily reach the temperature necessary for conserving foods.

☐ True
☒ False

If you marked False, explain why the statement is false: False, as crowding the refrigerator will possibly prevent it from reaching the temperature necessary for conserving foods. It hampers cold air circulation.

20. It is possible to store food products with chemical products, provided the location where foods are handled has an action plan in case of contamination by chemical hazards.

☐ True
☒ False

If you marked False, explain why the statement is false: Independently from the measures to adopt in emergency cases, food products should never be stored with chemical products.

21. A food handler should use a thermometer to make sure the center of the piece reaches the optimum cooking temperature. We consider the following temperature ranges:

- I. Below 5°C (41°F), proper refrigeration zone.
- II. Between 5°C (41°F) and 60°C (140°F), hazard zone.
- III. Above 60°C (140°F), proper cooking zone.

Answer:

- (1) Only I
- (2) Only II
- (3) Only III
- (4) I and II
- (5) All of the above.

22. One of the correct defrosting methods used by food handlers is to leave the food on the counter at room temperature.

☐ True
☒ False

Answer: No, this defrosting method favors bacterial proliferation, as it provides temperature and time for the multiplication of bacteria.

23. Both cooking and freezing help reduce the possibility of food-borne diseases.

☒ True
☐ False

If you marked False, explain why the statement is false:

24. The safest ways to defrost foods include the following:

- I. Refrigeration.
- II. Room temperature.
- III. Potable water.
- IV. Cooking.
- V. Microwave oven.

Answer:

- (1) Only I
- (2) Only II
- (3) Only III
- (4) I, III, IV and V
- (5) All of the above.

25. Very deep containers placed in the refrigerator are an unacceptable way of cooling potentially hazardous foods quickly. Stainless steel containers 10-15 cm (3.93-5.9 in) deep with a lid are recommended.

☒ True

☐ False

If you marked False, explain why the statement is false: _____

26. The following are considered CRITICAL POINTS as regards to contamination:

- I. Proper washing of hands and utensils prior to preparing foods (never work with rusty utensils).
- II. Conserving foods under refrigeration.
- III. Reheating foods at least at 60°C (140°F) to eliminate microbes.
- IV. Calculating exact quantities to be utilized in a short period, avoiding reheating and contaminating foods.
- V. Serving food with clean utensils, hygiene habits noticeable to clients, and presenting food correctly.

Answer:

(1) Only I

(2) Only I, II

(3) Only I, II, III

(4) I, III, IV and V

(5) All of the above.

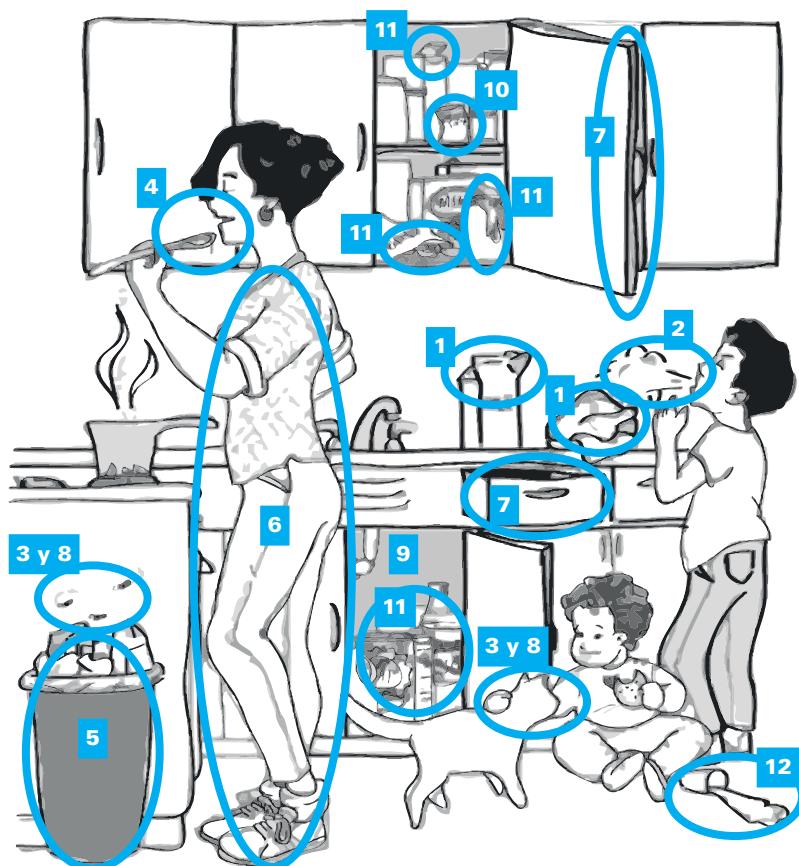
PART II:

Figure 1: What is wrong in this picture?



- | | |
|----------|-----------|
| 1. _____ | 7. _____ |
| 2. _____ | 8. _____ |
| 3. _____ | 9. _____ |
| 4. _____ | 10. _____ |
| 5. _____ | 11. _____ |
| 6. _____ | 12. _____ |

Answers for the instructor:



- | | |
|--|--|
| 1. Food products without refrigeration (chicken and milk). | 7. Drawers and doors open. |
| 2. Sneezing over food (chicken). | 8. Biological hazard vectors in the food handling area (cats and flies). |
| 3. Animals in the working area (cats and flies). | 9. Chemical products stored next to foods. |
| 4. Kitchen utensils for tasting (soup spoon). | 10. Storage in cans. |
| 5. Garbage container near the food handling area. | 11. Food products stored without proper sealing. |
| 6. Food handler's inappropriate clothing. | 12. Dirty working area. (Glass thrown in the food handling area). |

Figure 2: Identify these images and group them according to the type of hazard they represent, and which are the vectors of biological hazards.



Using the number of each drawing, indicate to which group they belong:

Physical hazards: _____

Biological hazards: _____

Chemical hazards: _____

Main vectors of biological hazards: _____

Main vectors of biological hazards:



Using the number of each drawing, indicate to which group they belong:

Physical hazards: **4, 8 and 12**

Biological hazards: **2, 3 and 10**

Chemical hazards: **6, 7 and 11**

Main vectors of
biological hazards: **1, 5 and 9**









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www.fao.org/home/en/

World Health Organization (WHO)

www.who.int/en/

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www.paho.org/hq

***Eat Safely* campaign**

www.fao.org/americas/recursos/come-sano/en/

