

FOOD SPOILAGE

All You Need To Know About It



A BOOKLET ISSUED BY THE IGEM TEAM OF IIT KHARAGPUR

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How Does This Booklet Help You?

This booklet serves as an informative guide for families, restaurants and catering services (in general) to help them adopt healthy food practices, reduce contamination and spoilage of food items and spread awareness about the various diseases which are caused due to consumption of contaminated food products. This booklet is made in a reader-friendly manner which enables even the simplest households to get a clear idea of the fundamentals of food spoilage.

What is Food Poisoning?

Food poisoning is an illness caused by eating contaminated food. Infectious organisms — including bacteria, viruses and parasites — or their toxins are the most common causes of food poisoning. It is an umbrella term that includes more than 250 different diseases caused mainly by bacteria such as *Campylobacter*, *Salmonella*, *Shigella* and *E. coli* and some groups of fungi and yeast.

Food poisoning can affect one person or a group of people who all ate the same food. It is more common after eating at picnics, school cafeterias, large social functions, or restaurants.

When germs get into the food, it is called contamination. This can happen in different ways:

- Meat or poultry can come into contact with bacteria from the intestines of an animal that is being processed.
- Water that is used during growing or shipping can contain animal or human waste.
- Food may be handled in an unsafe way during preparation in grocery stores, restaurants, or homes.

Food poisoning can occur after eating or drinking:

- Any food prepared by someone who does not wash their hands properly
- Any food prepared using cooking utensils, cutting boards, and other tools that are not fully cleaned
- Dairy products or food containing mayonnaise (such as coleslaw or potato salad) that have been out of the refrigerator too long
- Raw fish or oysters
- Raw fruits or vegetables that have not been washed well
- Undercooked meats or eggs
- Water from a well or stream, or city or town water that has not been treated

Infants and elderly people are at the greatest risk for food poisoning. You are also at higher risk if:

- You have a serious medical condition, such as kidney disease, diabetes, cancer, or HIV and/or AIDS that compromises your immune system.
- You travel outside of the country to areas where you are exposed to germs that cause food poisoning. Pregnant and breastfeeding women should use extra care to avoid food poisoning.

Causes of Food Spoilage

Since the beginning of civilization, preservation of food, has been necessary for our survival. It eliminated the need for regular hunting as food could be saved even during off-seasons. The preservation techniques which were practiced in early days, without any understanding of the microbiology, relied on inactivation of the interfering microorganisms through drying, salting, heating or fermentation. These methods are still used today albeit, newer methods have come up. Spoilage is characterized by any change in a food product that renders it unacceptable to the consumer from a sensory point of view. This may be physical damage, chemical changes (oxidation, color changes) or appearance of off-flavors and off-odors resulting due to microbial growth and metabolism in the product. Despite chill chains, chemical preservatives and a much better understanding of microbial food spoilage, it has been estimated that 25% of all the food, produced globally, is lost post-harvest or post slaughter due to microbial spoilage.

Each and every food product harbors its own characteristic microflora (community of microorganisms sharing a habitat) at any given point in time during production and storage. At the point of sensory rejection (spoilage), the so-called spoilage microflora (or spoilage association) is composed of two groups. There are microorganisms that have contributed to the spoilage and then, there are microorganisms that have grown but not caused unpleasant changes. This microflora is a function of the initial microflora and the processing, preservation and storage conditions. A selection process—based primarily on nutrient composition and on the chemical and physical parameters—lets similar microflora emerge in different food products under the same conditions despite the heterogeneity in the outset. Thus *Pseudomonas* spp. and a few other Gram-negative psychotropic organisms will dominate proteinaceous foods stored aerobically at chill temperatures. This is true for meat, poultry, milk and fish. The pseudomonads in pasteurized milk originate from post-process contamination (Eneroth et al., 2000) but the product may also spoil due to growth of psychotropic (bacteria capable of surviving in extreme cold conditions) *Bacillus* (Ternström et al., 1993) of which the spores have survived the heat treatment. If pH is high like in fish and “Dark, Firm and Dry” (DFD) meat, *S. putrefaciens*-like organisms develop in parallel, and may become the dominant spoilage organisms (Chai et al., 1968).

In meat and fish, a change in atmosphere, e.g. by vacuum-packing, will inhibit the respiratory pseudomonads and cause a shift in the microflora to lactic acid bacteria (LAB), *Enterobacteriaceae* and sometimes *Brochothrixthermosphacta* (Dainty and Mackey, 1992). Clostridia, which grow exclusively in anaerobic conditions, cause spoilage of vacuum-packed meats (Broda et al., 1996). They produce a neurotoxin called botulinum which causes the potentially fatal disease called botulism. *S. putrefaciens*, which is capable of anaerobic respiration, also grows and contributes to spoilage in meat with high pH. In fish, vacuum packaging selects for *S. putrefaciens* and for the CO₂-resistant, psychrotolerant marine bacterium *P. phosphoreum* (Dalgaard et al., 1993). A mild heat treatment of fish results in elimination of vegetative bacteria but, clostridia and *Bacillus* (that both survive as spores) may grow and spoil the product, especially if vacuum-packed (Ben Embarek, 1994).

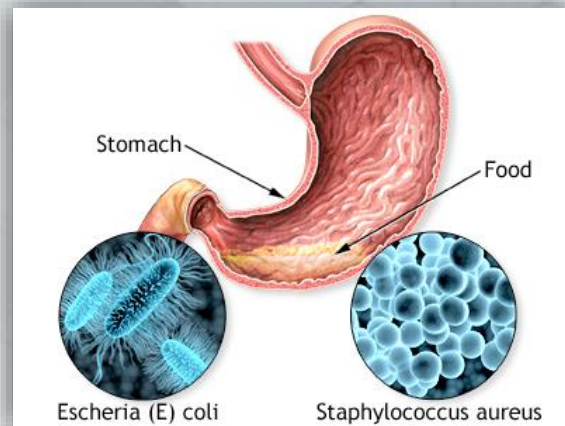
As we can clearly see, the dominant spoilage causing agent in a food product depends on the kind of treatment that a food product has gone through.

Organisms Involved in Spoiling Various Food Items

Food Product	Contaminating Bacteria
Fish	<i>Shewanella, Pseudomonas</i>
Fish	<i>Photobacterium, Shewanella</i>
Smoked fish	LAB, <i>Enterobacteriaceae, Photobacterium</i>
Marinated fish	LAB, yeasts
Meat	<i>Pseudomonas</i>
Meat	LAC, <i>Enterobacteriaceae, Brocothrix, Clostridia</i>
Meat products	LAC, <i>Enterobacteriaceae, Brochotrix</i>
Milk	<i>Pseudomonas, Bacillus</i>
Raw vegetables	<i>Erwinia, Pseudomonas, fungi</i>
Eggs	<i>Pseudomonas, Enterobacteriaceae</i>
Fruits	yeasts, filamentous fungi
Mayonnaise salads	yeasts, LAB
Beer	LAB, yeasts
Wine	LAB, yeasts
Cereals	Filamentous fungi
Nuts	Filamentous fungi

Symptoms and Treatment

Symptoms from the most common types of food poisoning often start within 2 - 6 hours of eating the food. That time may be longer or shorter, depending on the cause of the food poisoning. In case of campylobacter and parasites like Giardia, the symptoms may first appear as late as 10 days after consuming the tainted food.



Possible Symptoms Include

- Abdominal cramps
- Diarrhea (may be bloody)
- Fever and chills
- Headache
- Nausea and vomiting
- Weakness (may be serious)

Cases of food poisoning usually last for 1 or 2 days and the symptoms resolve on their own. However, if the symptoms persist longer, a healthcare professional should be consulted immediately.

Exams and Tests

Your healthcare provider will look for signs of food poisoning. These may include pain in the stomach and signs your body has too little fluid (dehydration).

Tests may be done on your stools or the food you have eaten to find out what type of germ is causing your symptoms. However, tests may not always find the cause of the diarrhea. In more serious cases, your healthcare provider may order a sigmoidoscopy. This test uses a thin, hollow tube with a light on the end that is laced in the anus to look for the source of bleeding or infection.

Possible Complications

The most common symptom associated with food-borne illnesses is diarrhea. Each pathogenic microorganism has its set of characteristic symptoms. The severity of the food borne illness depends on the pathogenic microorganism or toxin ingested, the amount of food consumed (dose), and the health status of the individual. For individuals who have immunocompromised health conditions, or for the aged, children, or pregnant women, any food borne illness may be life-threatening. Dehydration is the most common complication. This can occur from any causes of food poisoning. Less common, but much more serious complications depend on the bacteria that are causing the food poisoning. These may include:

- Arthritis
- Bleeding problems
- Damage to the nervous system
- Kidney problems
- Swelling or irritation in the tissue around the heart

Treatment

Most of the time, you will get better in a couple of days. The goal is to ease symptoms and make sure your body has the proper amount of fluids. Getting enough fluids and learning what to eat will help keep you comfortable. You may need to:

- Manage the diarrhea
- Control nausea and vomiting
- Get plenty of rest

You can drink oral rehydration mixtures to replace fluids and minerals lost through vomiting and diarrhea. Oral rehydration powder can be purchased from a pharmacy.

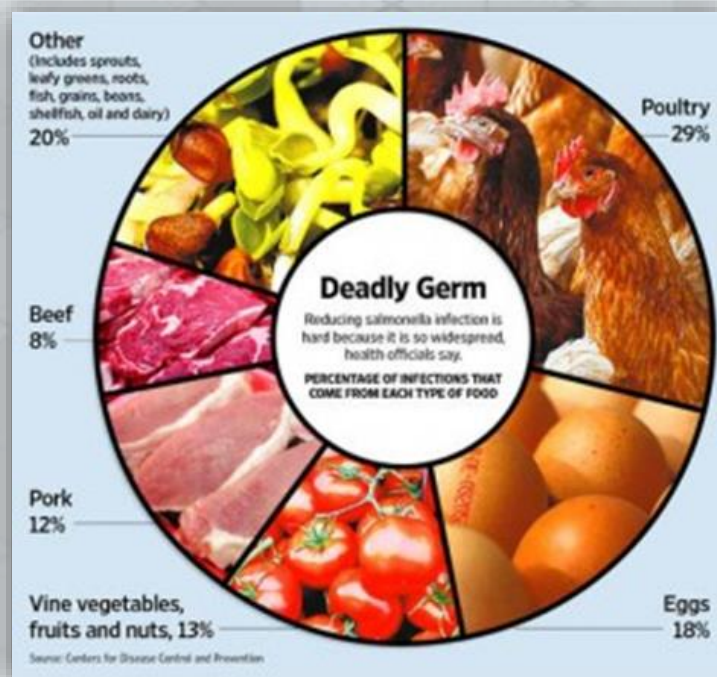
Alternatively, you can make your own mixture by dissolving $\frac{1}{2}$ teaspoonful each salt and baking soda and 4 table spoonful of sugar in 4 $\frac{1}{4}$ cups (1 liter) water. If you have diarrhea and are unable to drink or keep down fluids, you may need fluids given through a vein (by IV). This may be more common in young children.

If you take diuretics, ask your health-care provider if you need to stop taking the diuretic while you have diarrhea. Never stop or change medicines before talking to your doctor. For the most common causes of food poisoning, your doctor will NOT prescribe antibiotic

Why You Should Pay Attention?

- **Deadly Germs**

Poultry contributes the highest percentage(29%) followed by Eggs(18%),Green Vegetables, fruits and nuts(13%),then comes Pork(12%) and 20% is contributed by sprouts, fish, grains, oil and dairy collectively. So, we see pork is highly risky in terms of infecting the consumers, considering it's not so high percentage of consumption but still its contribution to infection percentage is high.



Percentage of Infections That Come From Each Type of Food

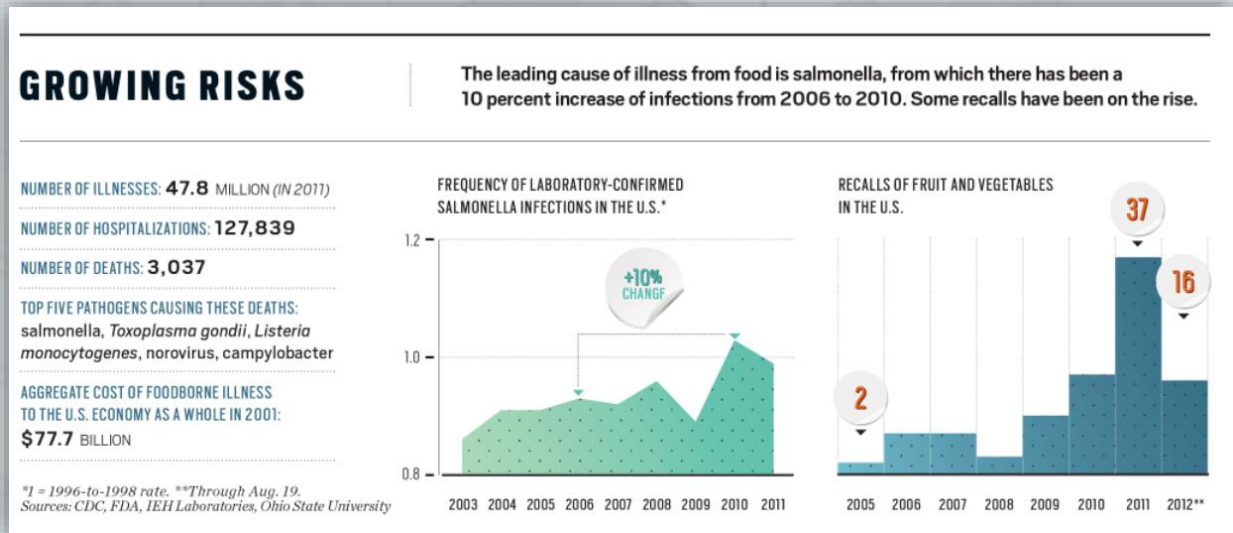


- **Growing Risks**

- Number of people affected by *Salmonella* alone in 2011 itself was 47.8 million. The number of deaths caused by *Salmonella* globally is 351,000.
- Numbers of hospitalizations were around 1.3 million.
- Top five pathogens causing food contamination related diseases with the total expenditure they have caused :

Salmonella [\$3.4 billion], *Toxoplasma gondii* [\$3.1 billion], *Listeria monocytogenes* [\$2.7 billion], *Norovirus* [\$2.1 billion] and *Campylobacter* [\$1.8 billion].

- There has been a 10% increase of infections from 2006 to 2011.

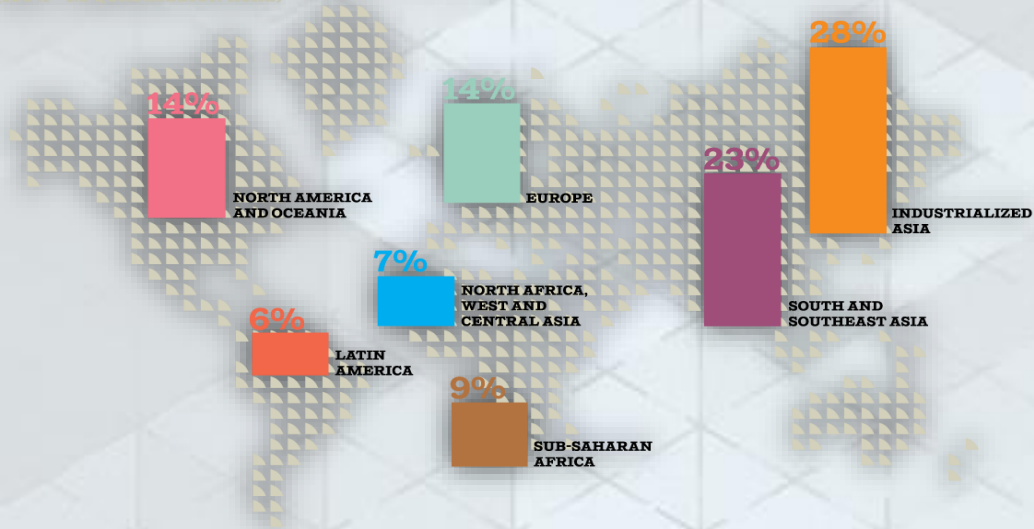


Disposal

- **Food Loss and Waste**

The highest contributor to Food waste and loss is Industrialized Asia [28%] followed by South and Southeast Asia [23%]. North America and Europe contribute 14% each, Sub-Saharan and North Africa contributes around 15% and Latin America [6%].

TOTAL SHARE OF GLOBAL FOOD LOSS AND WASTE, 2009
(Source: FAO, *Global Food Losses and Waste*)



SOURCE: WORLD RESOURCES INSTITUTE, UNEP, REDUCING FOOD LOSS AND WASTE, JUNE 2013

- **Shelf Lives of common food items**

Foods Unopened, Uncut, Uncooked unless stated otherwise	Counter	Refrigerator	Freezer
Apple	2-4 weeks	1-2 months	8-12 months
Bananas	2-7 days	5-9 days	2-3 months
Lemons	2-4 weeks	1-2 months	3-4 months
Carrots	Up to 4 days	4-5 weeks	8-12 months
Cucumbers	1-3 days	1 week	8-12 months
Potatoes	1 month	3-4 months	Do not Freeze
Tomato	5-7 days	2 weeks	8-12 months
Butter	10 days	1-3 months	6-9 months
Eggs	Few Hours	3-4 weeks	Do not Freeze
Milk	Few Hours	5-7 days	1month
Chicken	2 hours	1-2 days	1 year
Fish	2 hours	1-2 days	6-9 months
Bread	5-7 days	1-2 weeks	2-3 months
Ketchup	1 year	1 year	Do not Freeze
Soda	6-9 months, 3-5 months for diet	6-9 months, 2-5 days if opened	

What's the Deal with Expiration Dates?

- **“Use-By” and “Best Before”**

Provided voluntarily by the manufacturer to let you know how long the product will remain at its absolute best. The product is still edible after this date but taste may decline.

- **“Expires On”**

Found on Perishables like meat and dairy. This is a guide for stores to know how long they can display the product. You can eat the product beyond this date as long as it's stored properly.

- **“Sell-By”**

This is usually found on baby food or other products the government regulates with regard to dating. Do not consume past this date.

Safe Disposal of Spoilt Food

How to safely decompose contaminated or spoiled foods?

Spoiled food may contain dangerous microorganisms. Contact with these foods can lead to cross-contamination of consumable foods and food contact surfaces leading to foodborne illness. Food waste and decaying food may also attract disease carrying vermin and rodents. The following steps can be taken to avoid this:

- Food can be used as compost for soil. This will provide the necessary nutrients to the plants and is free of cost.
- Use food scraps such as fruits and vegetables, coffee grounds, eggshells, nutshells and tea bags.
- Do not dispose of meat, dairy or oils this way. Add the food waste to cardboard, newspaper, vegetation and other organic materials in your compost pile.
- Mix it in with soil and dirt so the food can be broken down. Dispose of cooking oils and fats by collecting them in a jar.
- Do not pour hot oil or fat from cooking meats down your sink drain. This will cause plumbing problems that may be expensive.
- Put meats and other foods that rot quickly into the trash on the day it will be collected.
- Rotting food will attract pests and insects. Tie meats and any raw foods you are disposing of into plastic bags before you put them into your trash bag. This will minimize leaks and odors.
- Cut down on your need to dispose of food by shopping and storing it properly, and by using leftovers. Freeze any fresh foods that you will not use right away so you can use them at a later date.

- Consider freezing leftovers such as soups, stews and pastas. Preserve or can any fruits and vegetables that you have a surplus of.
- You can find step by step instructions in books, or on websites such as Green Planet. Turn leftovers into extra meals or snacks.
- Look for recipes that use what you have left. Aim to use every bit of food that you cooked.
- Feed animals with your food waste. Contact local farmers to see if they would be interested in accepting your food scraps to feed their livestock. Let your household pets clean your plates.
- Check with your veterinarian to make sure you are not feeding your animals anything that might be dangerous to them.

Good Food Practices

Introduction

Any **household** can follow a set of very simple steps to ensure that the food they are consuming is not contaminated.

- **Respect 'Use by' dates** - Avoid buying any food product that is past its 'use by' date even if it looks and smells fresh.
- **Refrigeration**- Store all perishable food products in your fridge below 50°C.
- **Leftovers are bad** - Food should be consumed warm to avoid contamination. So, cook food according to requirement and avoid keeping leftovers. However, if you have cooked food that you are not going to eat, store it in a refrigerator as quickly as possible and avoid consuming food from fridge that is more than 2 days old.
- **Keep raw meat separately** - Raw meat should be kept away from ready to eat food like salads and preferably in the bottom shelf of the fridge where it can't touch other food or drip into them.
- **Wash your hands** - Wash your hands thoroughly before handling food. Avoid touching the bin, blowing your nose or touching any animals, including your pet, while cooking.

Restaurants and food joints are a major source of contaminated food. Contamination at such places often lead to major outbreaks. Hundreds of people might be affected simultaneously in case of such an outbreak. As such, authorities at such locations need to maintain the highest level of cleanliness and follow all necessary guidelines to ensure safety of their customers. As there is much handling involved to prepare the various dishes, adequate measures must be taken during preparation, transport and display to prevent contamination or spoilage of the buffet or catered food. This is to avoid unpleasant and costly incidents due to food-borne illnesses. As caterers/food retail outlet operators, you have a responsibility to provide safe food to your customers. The following set of guidelines describe several measures that an operator may implement in order to ensure that the buffet or catered food is wholesome and safe to consume.

Guidelines

A. Supervision

- Supervisors and managerial staff must constantly remind all personnel involved in food handling, preparation, packing, delivery and serving, the importance of following good food hygiene and safety practices.
- Everyone involved in the food catering chain is an important link to ensure the safety of the food from preparation to serving.
- There must be at least one trained Food Hygiene Officer (FHO) who directly supervises and is responsible for ensuring that the food handlers, work procedures, premises, preparation area, and equipment do not compromise food safety.
- Closer supervision and training must be conducted for newly-employed food handlers, particularly if they are part-timers or temporary workers. Pair up a new food handler with an experienced one.
- Supervisors must check all food handlers "state of health" and personal cleanliness at the beginning of each work day or shift. Sick food handlers should not be allowed to work and should see a doctor immediately.
- No unauthorized personnel should be allowed into the food preparation area.

B. Food Handlers

- All food handlers (including part-timers and temporary workers) must have completed the necessary training and be registered.
- Do not handle ready-to-eat food with bare hands at all times. Wear gloves and use proper utensils only. Do not use the same gloves to handle other items that can contaminate the food.
- Food handlers must wash their hands often with soap and water after visiting the toilet, after handling raw and uncooked food, and just before preparing and handling food.
- Food handlers should wear clean clothing and keep hair neat and tidy (long hair should be tied up using hair restraints). All jewelry and accessories should be removed. All wounds and cuts on the body should be covered with brightly-colored, waterproof plasters.

C. Storage

- Ensure that chilled food is stored at between 0°C and 4°C and frozen food is stored at -12°C or below. The chiller and freezer temperature gauges need to be properly calibrated. Do not overstock your chiller and freezer.
- Store raw food and ready-to-eat food separately in different chillers or freezers. If this is not possible, always store raw food in proper containers below ready-to-eat food. Practice first-expire-first-out principle when using food ingredients.

- Store dry food items in covered containers in a clean food storeroom. The lowest storage shelf should be at least 15cm above the ground. Clean up the food storeroom at the end of the shift or workday.
- No personal belongings (e.g. bags, shoes, and clothing), chemicals (e.g., pesticides, detergents, disinfectants) or any non-food related articles should be kept in the food storage area.
- All food products, cooked or uncooked in boxes, baskets, trays, etc. must not be placed directly on the floor. They must be placed off the floor on a shelf or rack.

D. Preparation

- Food pathogens multiply very rapidly between 50C and 60oC (temperature danger zone). Always keep food cold below 5oC or hot above 60oC. Cooked and ready-to-eat food should not be kept at room temperature for more than 2 hours during the whole process from preparation to delivery to site or serving.
- Do not take orders beyond your capacity to cope, as this may result in more lapses and can compromise food safety.
- Pre-plan the volume of food and the time needed for preparation to minimize the time food is left in the temperature danger zone of between 5oC and 60oC during the entire food catering process.
- Do not start preparing food too early in advance. Start preparation as close to the serving time as possible. If you need to start preparing some food early (e.g. thawing frozen meat, cutting meat, marinating), store the food back into the chiller until ready to cook. Never leave meat and other perishable food at room temperature to thaw or to marinate.
- Thaw frozen food in the chiller compartment overnight or in a microwave oven. If frozen food is thawed under running water, ensure that the food is sealed properly in plastic and does not come into contact with the water.
- Clean and sanitize all food contact surfaces such as preparation tables, sinks, equipment, utensils, implements, cutleries, cutting boards, etc. regularly. These surfaces should be cleaned after each use. Utensils and other kitchen equipment should be washed and cleaned between tasks or when handling different food items.
- Wash cutting boards and knives with hot, soapy water after preparing each food item and before going on to the next food item.
- Use separate cutting boards, knives, containers and cutleries for raw/uncooked food and ready-to-eat/cooked food. Color-code the cutting boards and knives to differentiate between those used for vegetables and fruits, those used for raw meat, and those used for cooked food. Make sure that the cutting boards and knives are clean always.
- Wash all vegetables and fruits properly, especially if they are to be eaten raw without further cooking.

E. Cooking

- Do not cook food too early in advance. Plan your cooking time such that food is cooked and packed as close to the delivery time as possible. If food has to be cooked early, ensure that the cooked or ready-to-eat food is stored above 60°C or below 5°C.
- Ensure that food is well-cooked and the internal temperature reaches at least 75°C. Use a food thermometer to measure the internal temperature of food at several places throughout the cooking process to ensure even and thorough cooking.
- The high-risk food items include poultry (chicken and duck), eggs and egg based products (e.g., mayonnaise, cake cream and frosting), meat, seafood, dairy products, rice and rice-based products (e.g., porridge, noodles), gravies and sauces, salads and all raw, ready-to-eat food. Please ensure these are well-cooked, and/or stored at the correct temperature (below 5°C or above 60°C). Do not keep rice, porridge and noodles at room temperature overnight.
- After cooking, take special care not to contaminate ready-to-eat/cooked food through improper handling, packing, storage, or cross-contamination by raw food, utensils and equipment.
- Pack and deliver as soon as possible after the food is cooked.
- If the cooked/ready-to-eat food is not ready to be transported out immediately, ensure that they are stored at the correct temperature. Cold or chilled food should be stored below 5°C, and hot food should be stored above 60°C. Never store food at room temperature. Use a food warmer or hot box to keep food hot at above 60°C while waiting to be transported.
- If the cooked food is to be stored for reheating later, cool the food down rapidly to below 5°C in a cold room or blast-chiller to control bacterial growth. Do not let food cool slowly at room temperature.
- Reheat food to at least 75°C. Reheat soup and gravy to a boil. Do not reheat in a slow cooker. Do not reheat more than once.
- If you do not have hot-holding or cold-holding equipment to keep food at the safe temperature (above 60°C or below 5°C), prepare food in small batches as close to the serving time as possible, and pack and deliver as soon as possible.
- Keep proper records of temperature checks when the batch of food is cooked and when it is to be consumed by. If you put food in hot-holding or cold-holding equipment, record the temperature and the time at which the food is put in and taken out.
- If there are staggered meal times for a function, cook the food in different batches and deliver in different batches. Cook each batch fresh before the designated delivery time.

F. Packing (Applicable to catering services only)

- Wrap or cover the food properly to prevent contamination.
- All catered food must be time-stamped. For packet meals, ensure that each individual packet has a time stamp label.
- Make sure that the packaging materials used for packed meals are food grade, and can withstand the temperature at which the food is kept.
- Put packed food into hot boxes, warmers or insulated containers and bags for transportation to site, so as to prevent rapid temperature drop for hot food. For cold food, keep in coolers with ice to maintain the temperature at below 5°C.

G. Transportation and Delivery (Applicable to catering services only)

- Make sure that the transport vehicle is clean and paneled with stainless steel on the inside for easy cleaning.
- Load chilled food items into the delivery vehicle last.
- Time your delivery such that the food is delivered as close to the meal time as possible. Delivering food too early to site results in food being left in the temperature danger zone for a long time before it is consumed, and increases the risk of food poisoning to customers.
- Transport the food directly to the site where it will be consumed. If possible, avoid delivering food to multiple sites in a single trip if this will result in prolonged storage of cooked food at incorrect temperature.
- Record the time of delivery for each of the event you are catering food for. 6. You may wish to consider including the time stamp information on your delivery order/invoice for your customer to sign and acknowledge receipt. Remember to provide the time stamp on the packet meals or buffets as well.

H. Setting-up and Serving

- Take care not to contaminate food when setting-up buffet tables or transferring food onto tables. Staff involved in assembling the dishes and serving food should wash or sanitize their hands and wear gloves before handling food.
- Display food in an orderly manner. Cooked food should be separated from raw/ready-to-eat food and served with separate utensils.
- Serve condiments in single-serving packets or clean containers with serving spoons. Do not reuse leftover condiments.
- Make sure that all chafing dishes, containers, crockery, etc. are clean.
- Provide clean serving spoons, ladles, tongs, plates/bowls, and cutlery.
- Keep food covered by using chafing dishes with attached covers. Do not open up the covers until it is time to serve.
- Once the food dishes are displayed, place sufficient number of canned fuel below to keep food hot. Place cold food in containers with ice.
- Replace canned fuels once they are used up.
- If food is to be reheated on-site, ensure that it is quickly heated to at least 75°C.

- Display the timestamp sign in a clearly-visible location for customers to see (e.g. on the table). At least one sign must be displayed at each buffet table.
- Provide food warmers and chillers on-site if the meal time runs for an extended period, such as in a big event. Portion out just enough food on the table and store the rest in hot boxes or electrical food warmers and chillers. Take them out from food warmers and chillers only when replenishing food on the table.
- For packet meals, keep them warm in hot boxes or insulated bags until ready to be collected by customers. Keep the cover of the hot box and bag closed as far as possible to prevent rapid heat loss.
- If the food catered by you is not set up by you on site but by another person/party/agent, you are required by law to provide the time stamp sign with the required information to the other person.
- It is an offence to remove, obstruct, deface, misuse, forge or alter the label or sign. Please make sure that you and your staff do not commit these offences.
- Avoid providing food packing containers to discourage customers from packing left-over food to eat beyond the “CONSUME BY” time you have advised.

I. Clearing up (Applicable to catering services only)

- After the “CONSUME BY” time has passed, clear up and remove all leftover food from the table as soon as possible. This is to discourage people from taking away the left-over food for later consumption. If your customers or their guests want to pack the left-over food for take-away, explain to your customers that it is not safe to eat the food after the “CONSUME BY” time indicated on the time stamp.
- Dispose of all food wastes and soiled crockery into plastic garbage bags, and tie the bags properly. If there are refuse bulk bins on site, dispose of the bags into the bulk bin. Otherwise, collect the garbage bags back to your premises for proper disposal.
- Clean and sanitize the vehicle after it is used for collecting soiled paraphernalia and garbage bags, before it is used again to transport food.

J. Preventing Pest Manifestation

- Eliminate Food Sources for Pests Maintain the cleanliness of the premises regularly.
- Clean kitchen and equipment thoroughly at the end of the day’s operation and ensure no food scrap/refuse is left behind.
- Clean the drains and gullies daily.
- Clean food/refuse spillage immediately. Practice good refuse management at the premises.
- Empty refuse bins at least once a day.
- Use proper foot pedal refuse bins that are lined with plastic bags.
- Keep refuse bins covered at all times when not in use.
- Bag, tie and dispose of all food wastes and garbage. Store food items at least 15 cm above the ground. Store food in tightly covered containers, metal cabinets or in

screened rat-proof rooms. Keep the areas below the cooking range and sinks dry and clean.

- Eliminate Shelters and Entry Points for Pests Dispose unwanted boxes, crates, piles of newspapers and other articles. Store goods properly and inspect the storage area regularly. Seal any holes or crevices in the ceilings, walls or floors.
- Ensure that floor traps and downpipe are properly covered with grating. Install strong wire meshes at doors and window where rodents are prone to enter.

K. Refrigeration

- Refrigeration slows bacterial growth and prolongs the freshness of food. Bacteria grow most rapidly between 50°C and 60°C, a temperature range known as the “Temperature Danger Zone”.
- Hence, it is important to maintain the correct temperature of refrigerators and to keep them clean so that frozen and chilled food remain safe.
- Food handlers should adopt the following guidelines when using the refrigerator:
 - Maintaining Safe Refrigerator Temperatures. Keep the temperature of chillers between 0°C and 4°C and the temperature of freezers at -18°C and below. Use a refrigerator thermometer (one that can read temperatures below 0°C) to ensure that the refrigerator temperature is correct.
 - The temperature inside the refrigerator can be determined by following the steps below:
 - ❖ Place the thermometer near the center of the refrigerator in a convenient, easy-to-read location and close the refrigerator door.
 - ❖ Leave the thermometer in the refrigerator for ten to fifteen minutes to allow the thermometer to obtain an accurate temperature reading.
 - ❖ Read the thermometer without taking it out of the refrigerator. If the thermometer reading is not within the range of 0°C to 4°C (for chiller) or -18°C and below (for freezer), adjust the thermostat dial to the required temperature.
 - ❖ Read the thermometer reading again after fifteen minutes. Use a non-mercury thermometer in the refrigerator as mercury thermometers may break and contaminate the food.
 - Ensure that both thermometer and refrigerator are in good working condition. Allow proper circulation of cool air by not overloading the refrigerator with too much food.
 - Cool air should circulate freely to keep food properly chilled. Avoid leaving the refrigerator door open for too long as this will raise the refrigerator’s temperature.

- Storing Food safely in the Refrigerator Store food at the correct temperature as soon as it has been delivered or prepared. This prevents growth of harmful bacteria and minimizes the risk of food spoilage.
- Store cooked and ready-to-eat food above raw food. This is to prevent cross contamination of the cooked or ready-to-eat food with the drippings from the raw food.
- Store food in separate, properly-covered containers in the refrigerator to prevent cross- contamination. Do not store marinated food at room temperature as bacteria can multiply rapidly in food at room temperature.
- Place marinated food in covered containers and store it in the refrigerator. Label food and include the date of purchase or preparation and the respective “use-by” date. Adopt a “first-in first-out” principle.
- Older food items that are stored in the refrigerator should be used first. Place hot food into shallow dishes or distribute them into smaller portions for rapid, even cooling before refrigeration.
- Alternatively, use a blast chiller to cool food down before storing it in the refrigerator.
- Do not store perishable food in the refrigerator door. Put them on the shelves in the main part of the refrigerator.
- The temperature of food stored in the door can increase when the refrigerator is opened.
- Keeping the Refrigerator Clean. Wipe spills immediately with a damp cloth and dry with a clean cloth. Clean the inside of the refrigerator using a clean sponge or cloth and warm, soapy water regularly.
- Rinse with a damp cloth and dry with a clean cloth. Wash removable shelves and drawers with warm, soapy water and rinse with clean water. Dry with a clean cloth.

L. Food Handling and Serving Practices

- Operators of food establishments should ensure that all service staff are aware of and follow proper food handling and serving practices to prevent contamination of food. The service staff should:
 - Turn away from food and cover their noses and mouths with tissue paper or handkerchiefs when sneezing or coughing. Wash their hands thoroughly after sneezing or coughing
 - Do not touch cooked or ready-to-serve food with bare hands when serving food. Care should be taken to ensure that their thumbs or fingers are not in contact with the food.
 - Always use tongs, ladles or spoons to handle cooked, ready-to-eat food or cut fruits. When necessary, wear disposable gloves when handling cooked ready-to-eat food or cut fruits. Discard the gloves after each use.
 - Handle crockery and utensils by the base, handle or areas that are not in contact with food. Ensure that crockery and utensils are not dirty, chipped, broken or cracked.

- Do not touch the inside and rim of cups or glasses. Use a food tray when serving drinks.
- Do not use bare hands to handle or place ice into glasses. Always use tongs, scoops or other ice dispensing utensils or equipment to handle ice.
- Always provide serving spoons to patrons who are sharing dishes.
- Do not serve cooked or ready-to-eat food which has dropped on the floor or exposed to contaminants e.g. cleaning chemicals, pests.
- Keep the dining environment clean and do not sweep crumbs or remnants onto the floor. Staff should wipe tables with clean cloth and sanitizer.



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