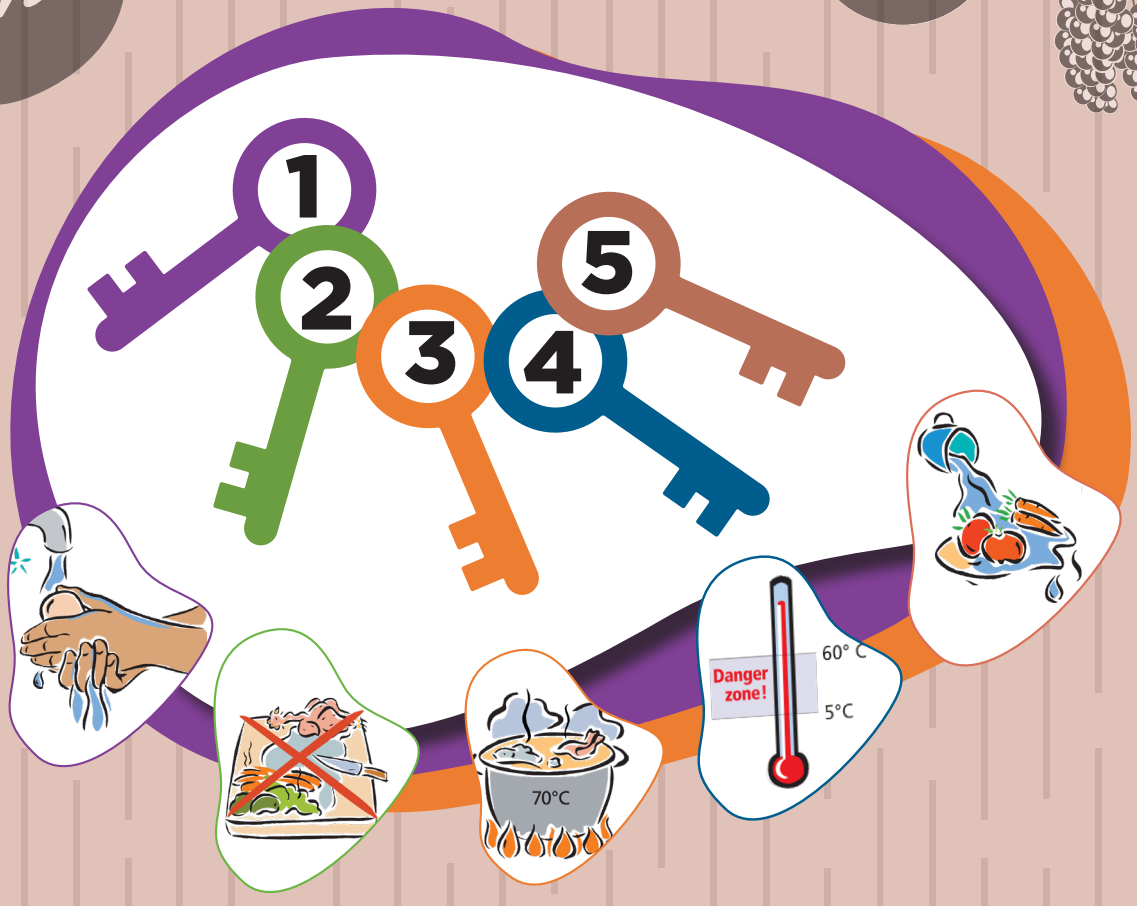
Five Keys to Safer Food Manual

FOR RESOURCE LIMITED RURAL AREAS IN DEVELOPING COUNTRIES



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PREFACE

Food contamination poses a significant global health challenge, causing widespread illness and death. The World Health Organization (WHO) estimates that foodborne diseases result in millions of deaths and Disability-Adjusted Life Years (DALYs) each year, with a burden comparable to that of malaria and tuberculosis. This problem is particularly severe in regions such as Asia and Africa, where tropical climates foster the growth of pathogens, and children are disproportionately affected.

To combat this issue, WHO introduced the Five Keys to Safer Food (WHO-FKSF) in 2001. These guidelines promote essential food safety practices: keeping clean, separating raw and cooked foods, cooking thoroughly, keeping food at safe temperatures, and using safe water and raw materials. While these practices are scientifically sound, their implementation in resource-limited settings often faces challenges related to cultural, societal, and infrastructural constraints.

This manual adapts the WHO-FKSF guidelines to the specific needs of developing countries, retaining the core principles in Section One while revising Section Two to reflect the realities of resource-constrained environments. For example, the key "Keep food at safe temperatures" has been revised to "Store food safely," emphasizing practical, non-refrigeration methods suited for areas without refrigeration infrastructure. Other keys have been carefully adjusted to ensure their relevance and practicality in these contexts. Additionally, the manual includes clear, evidence-based rationales for each action, providing a better understanding of the benefits of adopting these practices and encouraging broader implementation in resource-limited settings.

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INTRODUCTION

Food safety is a significant public health issue

Unsafe food has been a human health problem since history was first recorded, and many food safety problems encountered today are not new. Although governments all over the world are doing their best to improve the safety of the food supply, the occurrence of foodborne disease remains a significant health issue in both developed and developing countries.

It has been estimated that each year 1.8 million people die as a result of diarrhoeal diseases and most of these cases can be attributed to contaminated food or water. Proper food preparation can prevent most foodborne diseases.

More than 200 known diseases are transmitted through food.[1]

The World Health Organization (WHO) has long been aware of the need to educate food handlers about their responsibilities for food safety. In the early 1990s, WHO developed the ***Ten Golden Rules for Safe Food Preparation,*** which were widely translated and reproduced. However, it became obvious that something simpler and more generally applicable was needed. After nearly a year of consultation with food safety experts and risk communicators, WHO introduced the Five Keys to Safer Food poster in 2001. The Five Keys to Safer Food poster incorporates all the messages of the ***Ten Golden Rules for Safe Food Preparation*** under simpler headings that are more easily remembered and also provides more details on the reasoning behind the suggested measures.

The Five Keys to Safer Food Poster

The core messages of the Five Keys to Safer Food are: (1) keep clean; (2) separate raw and cooked; (3) cook thoroughly; (4) keep food at safe temperatures; and (5) use safe water and raw materials. The poster has been translated into more than 40 languages and is being used to spread WHO's food hygiene message throughout the world.

[1] Mead, P.S., et al, Food-Related Illness and Death in the United States Emerging Infectious Diseases, Vol 5, No. 5, 1999

The Five Keys to Safer Food Manual

The Five Keys to Safer Food Manual is divided into two sections. Section One is Background Material and Section Two is the Five Keys to Safer Food. Section Two elaborates the core food safety information provided in the WHO Five Keys to Safer Food poster and suggests how to communicate these messages. When presenting the material on the Five Keys to Safer Food it is important that this core information and rational (i.e. why) remain the same as that presented in the poster.

The information in Section One: Background Material is not meant to be presented in its current format. The trainer has flexibility on how and when to discuss the points provided in this section. The trainer should identify points within this section that are applicable to the audience and integrate these points into the presentation of the material in section two.

In both sections information is divided into two columns. The first column contains basic information that should be presented to all audiences. The second column contains additional information which is not designed to be presented to the audience, but is designed to aid the trainer in answering questions. For some sections, the manual also presents "Considerations and suggestions for the trainer", i.e. ways to adapt the material for different audiences and different locations.

When adapting the manual to prepare a training session, the following points and questions should be considered.

- Who is the audience (e.g. school children, young adults, home food handlers, food workers)?
- Will the audience understand the level of language used?
- Have enough visual cues been incorporated to accommodate those who might not understand the language?
- Is the material of an appropriate length to capture and hold the audience's attention?
- Are instructions clear, concise and easy to follow?
- Is the material presented in an interesting way that is easy to remember and understand?
- Does the material reinforce the core information?
- Have examples of local foods been incorporated?
- Are local food practices discussed?
- Does the material reflect local facilities (i.e., running water, refrigerators, etc.)?

Although the information provided in the Five Keys to Safer Food Manual will be adapted for each audience, the concepts of the core information should remain the same as that in the WHO Five Keys to Safer Food poster.

Evaluation

All aspects of the Five Keys to Safer Food training material should be evaluated. Included in the manual are two evaluation forms: one for the organizer and/or trainer and one for the participant. The evaluation form for the organizer and/or trainer evaluates the demographics of the audience and the suitability of the adaptation process and whether or not the training session achieved its goal. The evaluation form for the participants evaluates the impact of the training session on food safety knowledge, attitude and behaviours. It is recommended that the participants complete one evaluation form before the training session and one evaluation form after the training session.

Glossary

A glossary of terms used in the manual is provided for reference.

Resources

This section contains additional information for the organizer, trainer and participants. In addition to this manual, WHO intends to develop supplemental materials targeted to different audiences including school children and women as well as other supplemental materials on different food safety topics. When developed this information will be available at the web site: **www.who.int/foodsafety/consumer/5keys/en/index.html**

WHO aims to improve the exchange and reapplication of practical food safety knowledge among Member States by having them exchange experiences and tested solutions. A section of the WHO Food Safety web site was designed to enable countries and partners to access the different tools produced in different parts of the world. One can actively contribute to the success of delivering the Five Keys to Safer Food public health message and prevent foodborne disease by exchanging ideas, materials and experiences on this web site.

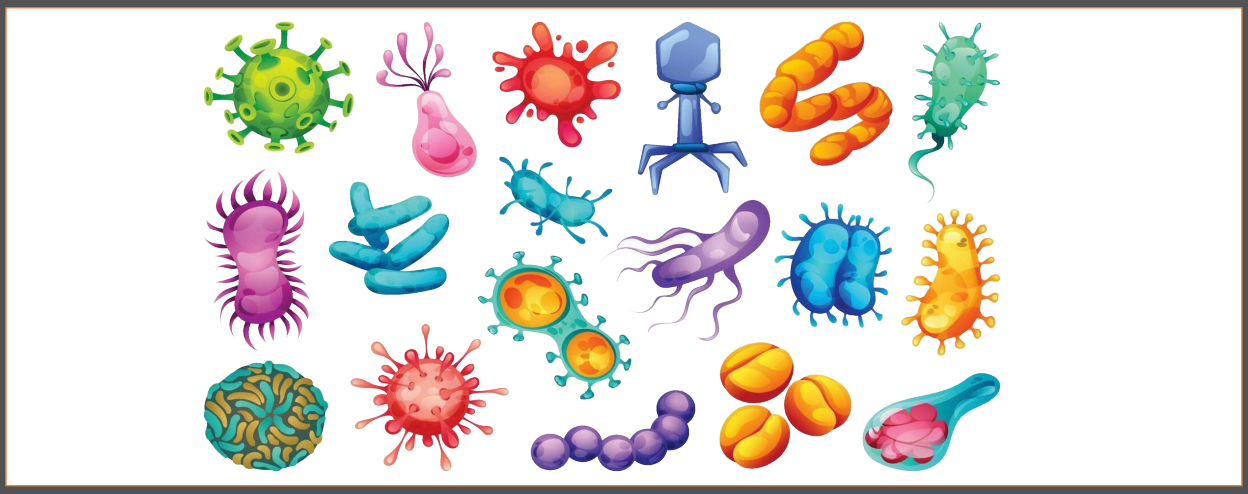
SECTION 1

BACKGROUND MATERIAL

What is the problem?	Additional information
Every day people all over the world get sick from the food they eat. This sickness is called foodborne disease and is caused by dangerous microorganisms and/or toxic chemicals. Most foodborne disease is preventable with proper food handling.	Foodborne Disease: ▪ Is a problem in both developing and developed countries; ▪ Is a strain on health care systems; ▪ Severely affects infants, young children, elderly and the sick; ▪ Creates a vicious cycle of diarrhoea and malnutrition; and ▪ Hurts the national economy and development and international trade.

Considerations and suggestions for the trainer

For simpler language, use the terms “germ” for microorganisms and “poisons” for toxic chemicals.



What are microorganisms?

Microorganisms are very small living things, so small that they cannot be seen with the naked eye. There are three different types of microorganisms: the good, the bad and the dangerous.

Good microorganisms are useful. They:

- Make food and drinks (e.g. cheese, yoghurt, beer and wine);
- Make medicine (e.g. penicillin); and
- Help digest food in the gut.

Bad microorganisms, or spoilage microorganisms, do not usually make people sick, but they cause our food to smell bad, taste horrible and look disgusting.

Dangerous microorganisms make people sick and can even kill. These are called "pathogens". Most of these microorganisms do not change the appearance of the food.

Additional information

Microorganisms are so small that it takes 1 million to cover the head of a pin.

Bacteria, viruses, yeasts, moulds and parasites are all microorganisms.

The smell, taste and appearance of food are not good indicators of whether the food will make you sick. Some spoilage microorganisms do change the appearance of food and are dangerous. An example is the green mould on bread which can produce toxins.

Examples of common dangerous foodborne microorganisms include:

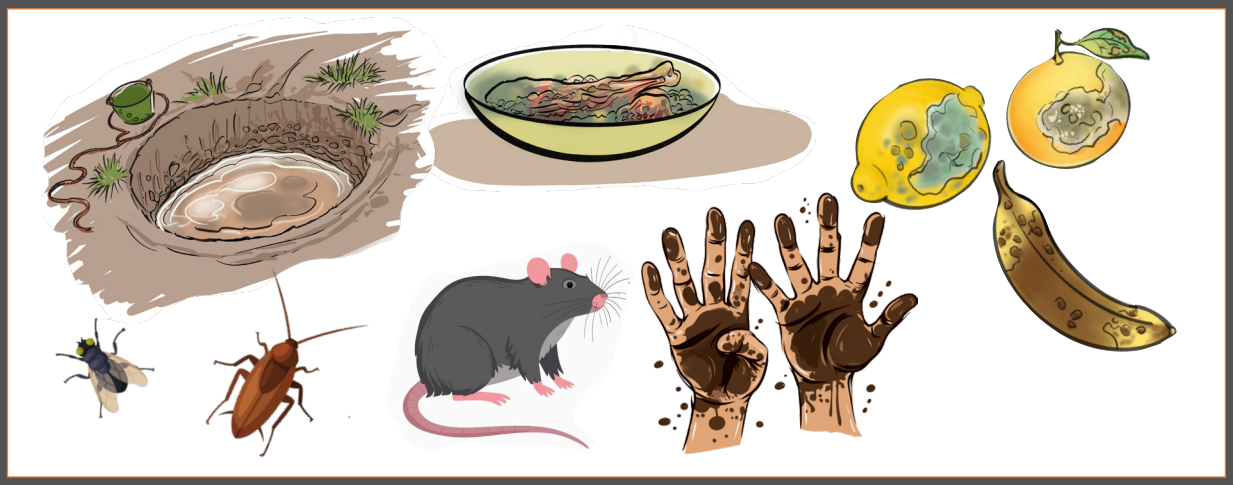
Bacteria - *Salmonella, Shigella, Campylobacter and E. coli;*

Parasites - *Giardia, Trichinella*; and

Viruses – *Hepatitis A, Norovirus.*

Considerations and suggestions for the trainer

- Become familiar with dangerous microorganisms in your region.
- It may be appropriate to change the example showing the relative size of a microorganism. For example, 10 000 bacteria side by side would occupy one centimetre of space.
- Providing pictures or actual examples of mouldy fruit may add interest, but it must be stressed that dangerous bacteria may not always make the food smell, taste or look bad.



Where do microorganisms live?	Additional information
Microorganisms are everywhere, but are mostly found in: ▪ Faeces; ▪ Soil and water; ▪ Rats, mice, insects and pests; ▪ Domestic, marine and farm animals (e.g. dogs, fish, cows, chickens and pigs); and ▪ People (bowel, mouth, nose, intestines, hands, fingernails and skin).	Human and animal faeces contain disease-causing microorganisms. A single teaspoon of soil contains more than 1 billion microorganisms. All living things have microorganisms associated with them. Animals carry microorganisms on their feet, in their mouths and on their skin. An average 100 000 bacteria can be found on each square centimetre of human skin.

Considerations and suggestions for the trainer

- Name common sources of microorganisms in the local region.

How do microorganisms move?	Addittional information
Microorganisms rely on someone or something to move them around. The transfer of microorganisms from one surface to another is called "contamination". Hands are one of the most common means of moving microorganisms from one place to another. Microorganisms can be spread through contaminated food and water. Pets and domestic animals can also be a source of contamination.	If a food handler is infected with a virus and continues to prepare food, some viruses may be passed on to the consumer via the food. Hepatitis A and Norovirus are examples of viruses which can be transmitted in this way. Zoonoses are communicable diseases caused by microorganisms transmitted from animals to humans. Avian influenza and infections with E. coli 0157 are examples of zoonoses. Avian influenza can be transmitted to humans through direct contact with an infected bird or objects contaminated by their faeces.

Considerations and suggestions for the trainer

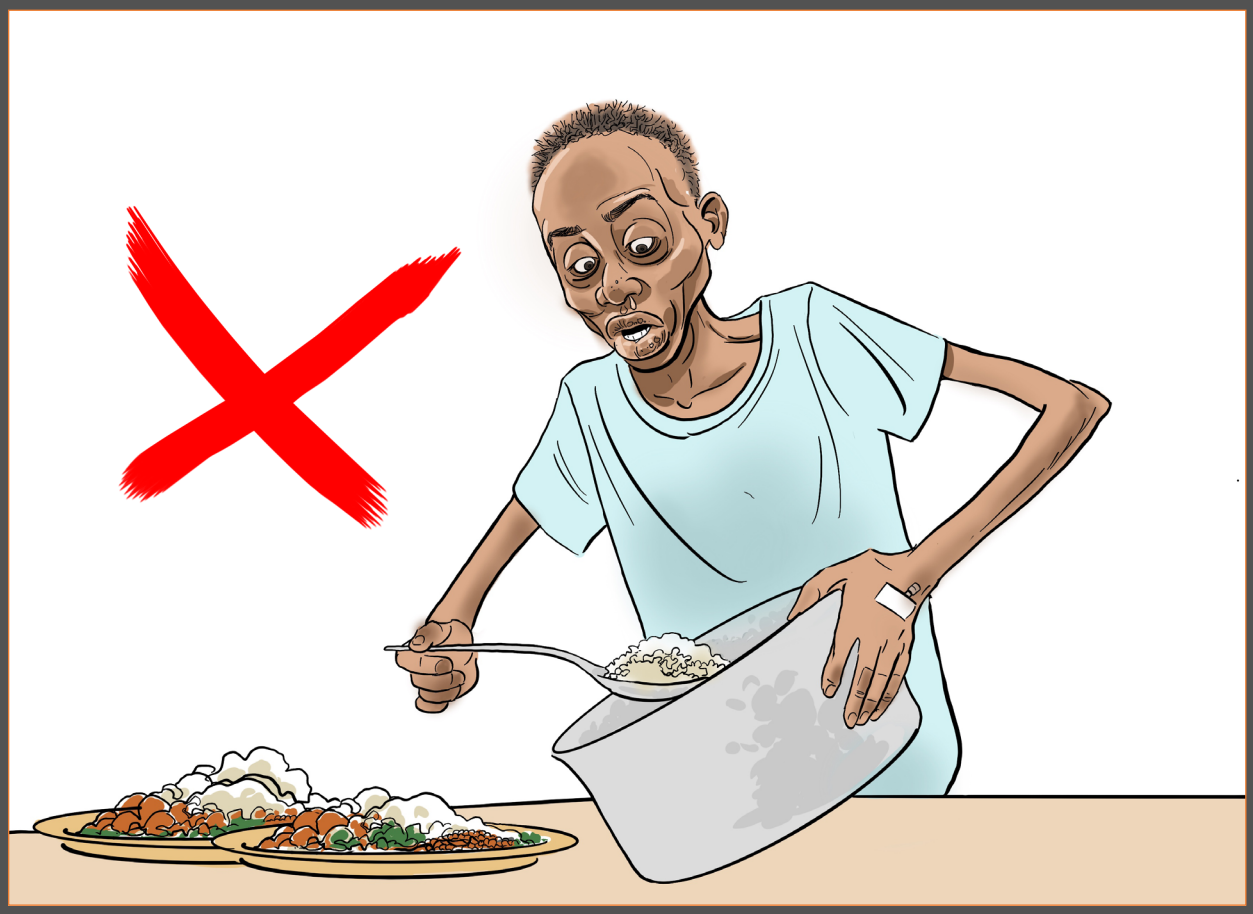
- Give a demonstration of contamination by touching your hand to your face and then touching some food with that same hand.
- Discuss a local foodborne disease outbreak, including the cause of the outbreak and what could be done to prevent infection in humans.

How do microorganisms grow?	Additional information
Most microorganisms "grow" by multiplication. To multiply, microorganisms need: ▪ Food; ▪ Water; ▪ Time; and ▪ Warmth. Meat, seafood, cooked rice, cooked pasta, milk, cheese and eggs are foods that provide ideal conditions for microorganisms to grow.	One bacterium can become 2 in just 15 minutes. This means that within 6 hours, 1 bacterium can multiply to over 16 million. To be harmful, some bacteria need to grow to high levels. Other bacteria can cause illness when they are present in very low numbers. Viruses are many times smaller than bacteria. They do not grow in food or water, but these are vehicles for transmission.

Considerations and suggestions for the trainer

- Discuss local foods that do and do not provide the ideal conditions for growth of microorganisms.
- Dried beans, pebbles or other objects can be used to demonstrate bacterial growth. As an example of quick growth start with one object, in 15 seconds make it two objects, in another 15 seconds make it 4 objects and in another 15 seconds make it 8 objects, etc. (double the number of objects you have every 15 seconds). Please note that 15 seconds is used instead of 15 minutes so that it is possible to show how bacteria grow during a training session.

What are the symptoms of foodborne disease?	Additional information
Every year, billions of people experience one or more episodes of foodborne disease, without ever knowing that their illness was caused by food. The most common symptoms of foodborne disease are: ▪ Stomach pains; ▪ Vomiting; and Diarrhoea. The symptoms depend on the cause of the disease. Symptoms may occur very quickly after eating the food, or may take days or even weeks to appear. For most foodborne diseases, symptoms occur 24 -72 hours after the food has been eaten. Foodborne disease can lead to long-term health problems. Very severe diseases, including cancer, arthritis and neurological disorders can be caused by contaminated food.	For infants, the sick, pregnant women and the elderly, the consequences of foodborne disease are usually more severe and more often fatal. Drinking plenty of fluids will maintain hydration during diarrhoea. It is estimated that 3% of cases of foodborne disease can lead to long-term health problems. Mouth masks are recommended for people who may cough or sneeze while handling food. Gloves can be used to cover any cuts or lesions and should be changed frequently. Advice on treatment of foodborne illness differs between countries and should be adapted to the local region. However, one should seek medical advice when bowel movements are very frequent, very watery or contain blood, or last beyond 3 days.



What to do if you get sick

Try not to handle or prepare food while you are sick and for 48 hours after your symptoms stop. However, if this cannot be avoided, wash your hands with soap and water first and frequently during food preparation.

When symptoms are severe seek medical advice immediately.

Some foodborne diseases can be transferred from person to person. Caregivers can become sick from patients with a foodborne illness.

Considerations and suggestions for the trainer

- Food industry workers need to notify their employers of the following: Hepatitis A, diarrhoea, vomiting, fever, sore throat, skin rash, other skin lesions (e.g. boils, cuts, etc.) or discharge from ears, eyes or nose.
- High risk activities such as slaughtering and preparing ready to eat foods may require special personal protective equipment. Contact the local government authority for more information.

Chemicals should not be forgotten	Additional information
Microorganisms are not the only cause of foodborne illness. People also get sick from poisonous chemicals, which include: ▪ Natural toxins; ▪ Metals and environmental pollutants; ▪ Chemicals used for treating animals; ▪ Improperly used pesticides; ▪ Chemicals used for cleaning; and ▪ Improperly used food additives. Simple measures such as washing and peeling may reduce the risk from chemicals that are found on the surface of foods. Appropriate storage can avoid or reduce the formation of some natural toxins.	"Poisoning" is a term used to describe sickness resulting from chemical contamination. Some "natural" toxins (e.g. aflatoxin) are caused by moulds growing on the food. Ingesting aflatoxins may have harmful effects on the liver that can lead to cancer.

Considerations and suggestions for the trainer

- It may be useful to elaborate on some of the chemicals that are a threat to specific populations (e.g. methylmercury, arsenic).
- Discuss the importance of reading and understanding instructions on the labels of chemicals used for cleaning.
- Using cookware and utensils glazed with materials containing heavy metals (e.g. lead, cadmium) can result in chemical poisoning. Discuss appropriate cookware.

You can make a difference	Addiional. Information
Stop microorganisms from making you and other people sick by following the Five Keys to Safer Food: 1. Keep clean; 2. Separate raw and cooked; 3. Cook thoroughly; 4. Keep food at safe temperatures; and 5. Use safe water and raw materials.	It is very important to follow the Five Keys to Safer Food because proper food handling is key to foodborne disease prevention. These messages are core information and should be presented to all audiences. In some countries, it may be necessary to address the use of safe water and raw materials before presenting the Five Keys to Safer Food.

SECTION 2

THE FIVE KEYS TO SAFER FOOD

KEY 1 KEEP CLEAN

Rationale While most microorganisms do not cause disease, dangerous microorganisms are widely found in soil, water, animals and people. These microorganisms are carried on hands, wiping cloths and utensils, especially cutting boards, and the slightest contact can transfer them to food and cause foodborne diseases.

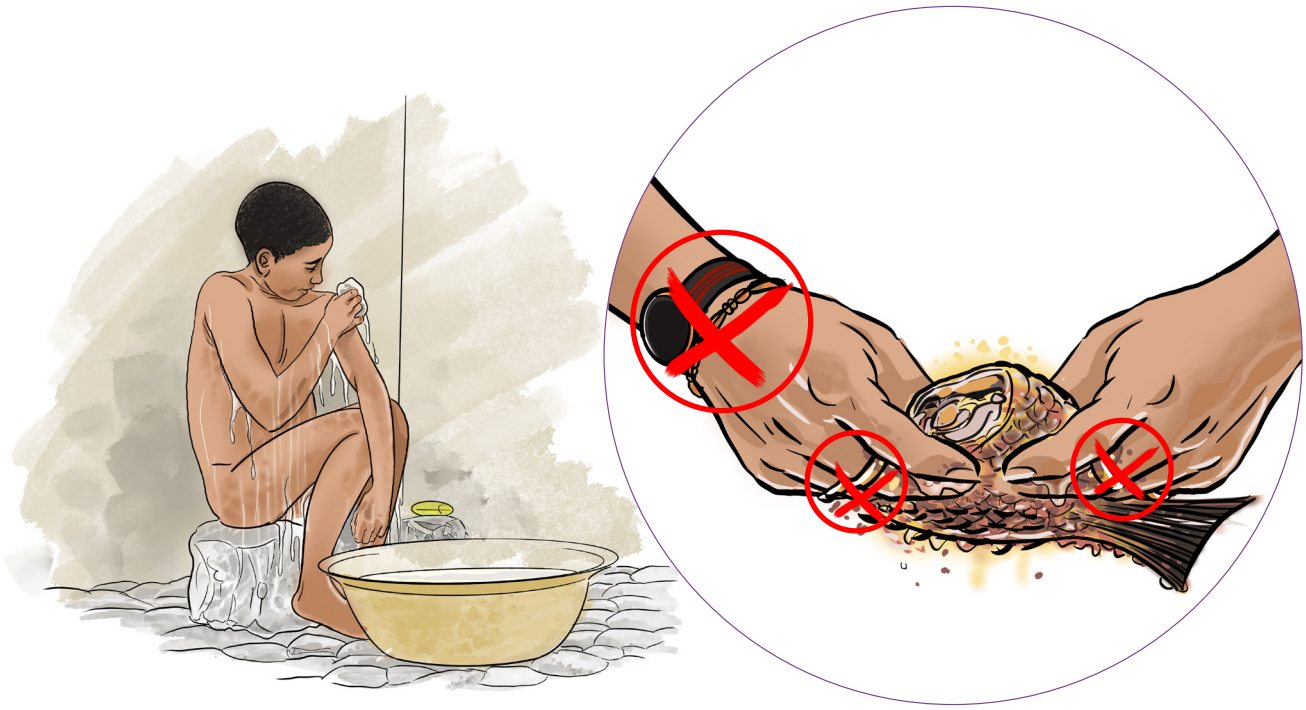
Wash hands before and after handling food and often during food preparation and after visiting the toilet

Recommendations (What?)	Reasoning behind the Recommendations (Why?)	Actionable steps to Achieve Recommendations (How?)
Wash hands under the following circumstances 1. Handling or Consuming Food ▪ Before handling food and often during food preparation ▪ Before eating ▪ Before breast feeding and expressing breat milk 2. After Contact with Bodily Fluids or Waste ▪ After going to the toilet ▪ After changing a baby's nappy (diaper) ▪ After blowing your nose ▪ After changing sanitory pads ▪ After sneezing and coughing 3. After Handling Potentially Contaminated Items ▪ After handling raw meat or poultry (these items naturally carry pathogens) ▪ After handling rubbish and manure ▪ After handling chemicals (including those used to clean) 4. After Interacting with Animals ▪ After playing with pet animals or slaughtering animals including poultry 5. After Touching Different parts of the body eg nose, mouth and hair	Hands can transfer harmful microorganisms to food, leading to contamination and foodborne diseases.	Wet hands with running water, apply soap, rub hands together for at least 20 seconds (paying special attention to fingernails, thumbs, wrists, and in between fingers), then rinse thoroughly with running water. Dry hands with a clean towel or air dry. Towels should not be shared.

Additional information

- Why wash hands with soap and running water? Answer: Soap breaks down oils, dirt, and germs, while running water rinses them away. Using static water, like in a basin, can lead to recontamination
- What to do if there's no tap water? Answer: Set up tippy-taps (containers with taps) near kitchens, eating areas, and toilets. Tip-taps use minimal water, providing an effective handwashing solution where running water is scarce.
- In areas where soap is unavailable, rub hands with coal ash and rinse thoroughly with water. **It is not as effective as soap, but it can be a temporary alternative when soap is not available.**
- Don't hesitate to ask for running water and soap. Asking for soap and running water in public or when visiting others ensures your hygiene and helps prevent the spread of disease. A single compromise at the visit can harm your health.
- Encourage men and boys to actively participate in collecting and transporting water, especially where reliable water sources are scarce.

Maintain general body hygiene when handling food



Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Take daily showers and wear clean clothes	Bathing and wearing clean help minimize the transfer of pathogens from the body to food, reducing the risk of foodborne illness.	Food handlers should shower daily, wear clean, laundered uniforms, and maintain short, clean fingernails.
Avoid handling food when sick, especially with symptoms like fever, diarrhea, or vomiting	Illnesses like gastrointestinal infections are highly contagious and can easily spread through food, affecting multiple consumers.	Avoid work until symptom-free for at least 48 hours.
Cover skin cuts or wounds with a clean, waterproof bandage and wear gloves	Open cuts are potential entry points for bacteria, which can transfer to food and contaminate it.	Clean any cuts with antiseptic and cover them with a waterproof bandage. Use disposable gloves on hands with cuts, and replace gloves as needed.
Remove personal items, such as jewelry and watches, before food handling	Personal items can harbor bacteria and are difficult to clean, potentially contaminating food.	Remove jewelry and watches etc, before food handling

Clean plates, utensils and surfaces

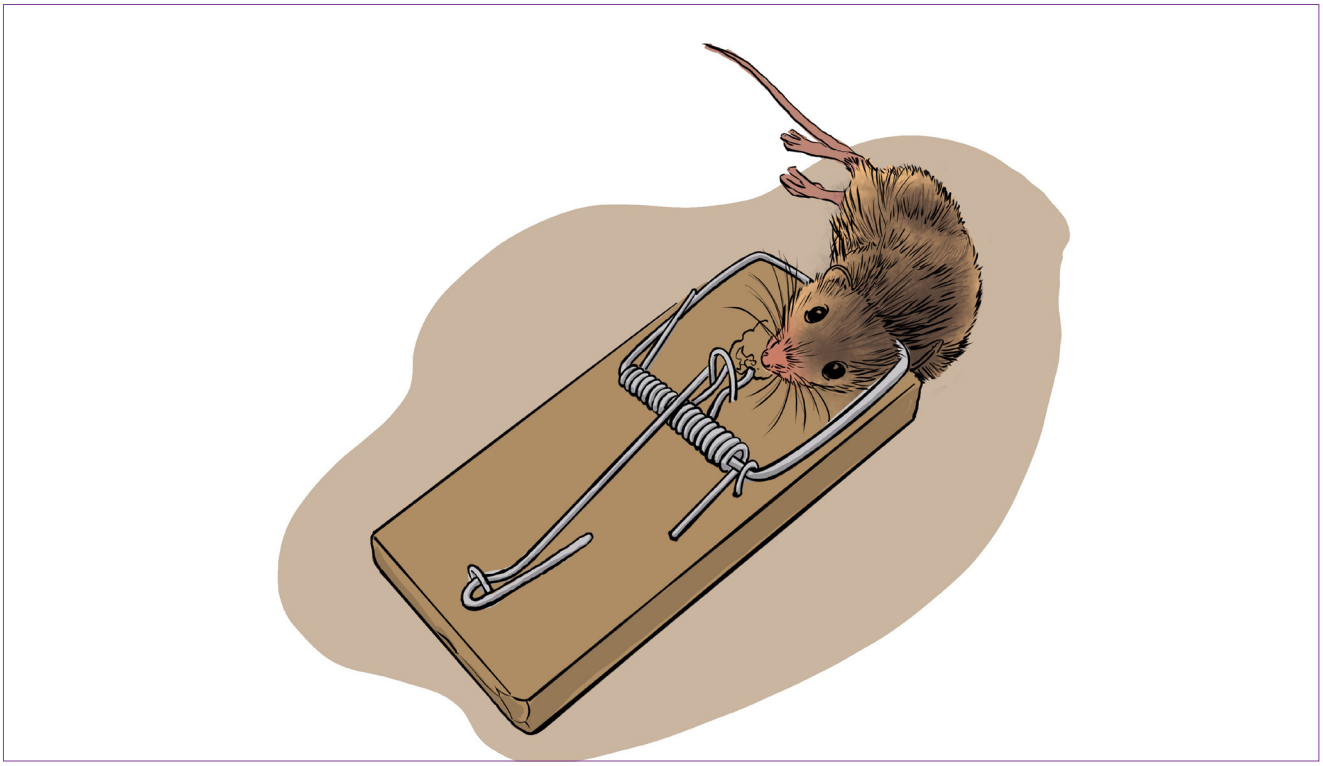
Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Clean and sanitize plates, utensils, and cutting boards regularly during food preparation.	Cleaning during food preparation prevents the buildup of microorganisms and reduces the risk of cross-contamination between raw and cooked food.	Wash utensils with hot water and detergent. Pay attention to items that touch raw food. Sanitize any utentils after contact with raw meat, seafood, or poultry.
Properly clean and sanitize all dishes and utensils after meals.	Leftover food and grease provide ideal conditions for bacterial growth, especially in damp environments.	Scrape excess food into a rubbish bin, wash with hot water and detergent, rinse in hot water, sanitize with boiling water or bleach solution, and air-dry or wipe with a clean, dry cloth.
Keep cloths, towels, and cleaning utensils clean and dry.	If not properly maintained, cleaning utensils, cloths and towels can harbor bacteria and spread contamination.	Change cloths daily. Avoid sponges, use separate cloths for different tasks, and ensure cleaning utensils are dried after use.

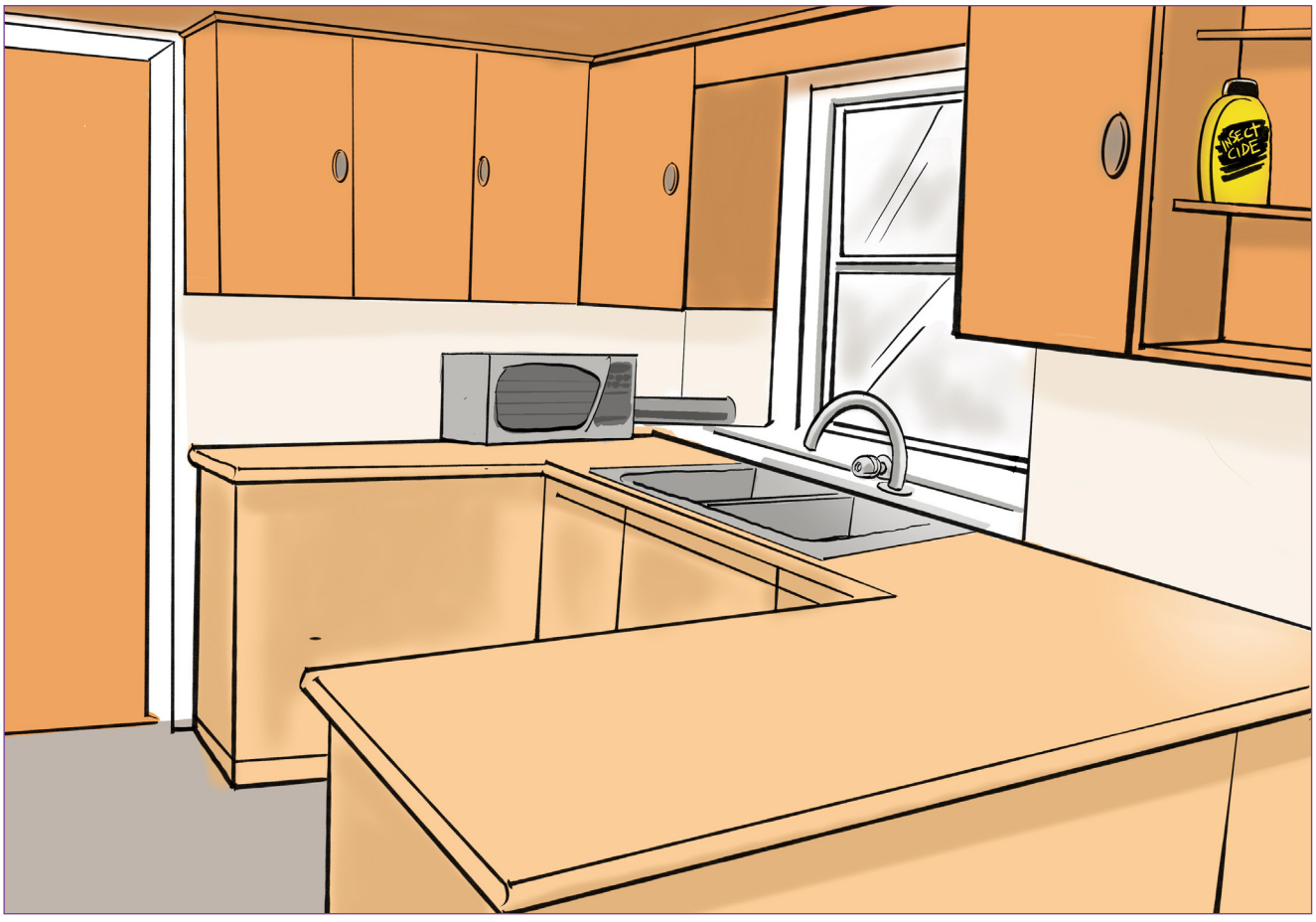
Use or make own homemade bleach solution to sanitize utensils and surfaces.	Proper sanitization kills harmful germs that remain after cleaning.	Mix 5 ml of household bleach in 750 ml of water and use it for sanitizing utensils, surfaces, and cloths. Let the solution sit for at least 30 seconds before rinsing. Alternatively, boil water and sanitize the items by submerging them for at least 1 minute. **Notes**: • Use only plain, unscented bleach without additives for sanitizing. • Always prepare the bleach solution fresh before use, as its effectiveness decreases over time. • Ensure proper ventilation while using bleach to avoid inhaling fumes.
Dry washed utensil and plates outdoors in direct sunlight whenever possible. If drying outdoors is not feasible (e.g., due to weather conditions), use indoor drying in a clean, ventilated space.	Sunlight's Natural Disinfecting Properties: Sunlight provides UV rays that kill residual bacteria, promoting sanitation. It also speeds up drying, reducing moisture where bacteria could thrive.	Outdoor Sun Drying (Preferred Method) • Place a clean drying rack or mat in a sunny, dust-free area outside. • Position plates so they're tilted to allow water to drain off, encouraging airflow and faster drying. • Use a light cover (such as a mesh or cloth) to protect plates from dust and insects. Indoor Drying (Alternative) • Choose a well-ventilated indoor space, ideally near a window for indirect sunlight or airflow • Arrange plates on a drying rack with space between them to allow air circulation and prevent moisture retention • Avoid enclosed, damp areas to reduce the risk of bacteria and mold.

Additional information

- What is the difference between Cleaning and Sanitizing?
  - Cleaning: Involves the removal of visible dirt, grease, and food particles using hot water and detergent.
  - Sanitizing: Involves killing germs and bacteria that aren't visible, using boiling water or a bleach solution (5 ml bleach in 750 ml water).
- Cleaning addresses physical dirt, while sanitizing eliminates harmful pathogens. Both are crucial for maintaining safe food handling practices.

Protect food preparation areas from pests and animals





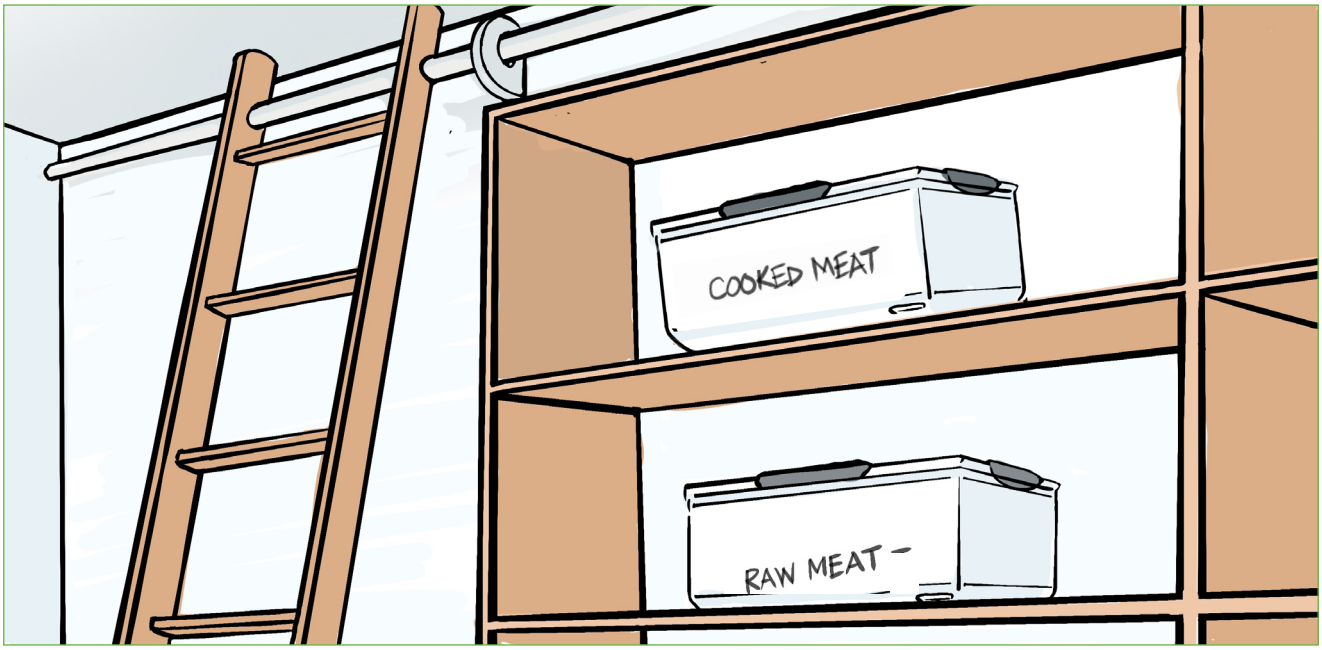
Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Protect food preparation areas from pests	Pests such as rats, mice, birds, cockroaches, flies, and other insects can carry harmful microorganisms that contaminate food and surfaces. Pets can carry pests like fleas and ticks, which also pose contamination risks.	▪ Keep food covered or in closed containers. ▪ Use clean food nets to cover food and prevent insects from landing on it. Altenatively designated cloth can be used... ▪ Keep rubbish bins covered and properly dispose rubbish regularly.Where bins are not availble deep pits (away from kitchen area) ▪ Repair cracks or holes in walls to maintain kitchen areas. ▪ Use baits or insecticides carefully to avoid food contamination. ▪ Keep domestic animals away from food preparation areas. ▪ Proper housing to keep them away from food preparation area
Maintain pest-free food environments	Pests can transfer harmful microorganisms to food, leading to foodborne diseases. Cats, for instance, can carry parasites that cause serious illness, especially harmful to unborn babies.	▪ Regularly clean and sanitize kitchen surfaces and utensils, especially where it is difficult to be completely pest-free. ▪ Adjust pest control measures based on the common pests in the specific area. ▪ Use food nets to protect food from flying insects and pests.

Additional Information:

- Discuss ways to eliminate pests from food preparation and storage areas.
- In some situations, it may be impossible to ensure that the kitchen is totally pest-free. In such cases, clean and sanitize surfaces and utensils before cooking.
- Cats carry a parasite that can contaminate food and cause serious disease in unborn babies. Keep cats away from food preparation and storage areas.
- Vaccinate pets to reduce the risk of zoonotic diseases that could be transmitted to humans

KEY 2 SEPARATE RAW AND COOKED

Rationale: **Raw food, especially meat, poultry and seafood and their juices, can contain dangerous microorganisms which may be transferred onto other foods during food preparation and storage.**



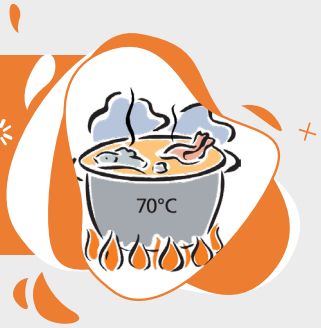
Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Separate raw and cooked foods	Raw foods, especially meat, poultry, and seafood, contain dangerous microorganisms that can be transferred to other foods, leading to cross-contamination and foodborne illness.	▪ While shopping or sourcing, keep raw meat, poultry and seafood separate from other foods. ▪ Store food in containers with lids to avoid contact between raw and prepared foods. If resources are limited, designate specific areas or surfaces (e.g., separate corners or simple mats) for handling raw and cooked foods. ▪ Use available materials (e.g., reusable cloths or separate plates) to keep raw and prepared foods separate.

Prevent cross-contamination	Cross-contamination is the transfer of microorganisms from raw to cooked or ready-to-eat foods, which can occur at any stage, including slaughtering and marinating.	▪ Use separate equipment and utensils such as knives and cutting boards for handling raw foods ▪ If access to multiple utensils is limited, wash knives, plates, and surfaces with clean water and soap between handling raw and cooked foods. ▪ If containers are scarce, use basic alternatives such as plastic bags or natural covers like banana leaves to keep raw and cooked foods separate. ▪ In the refrigerator, store raw meat, seafood and poultry below cooked or ready to eat foods to avoid cross-contamination. Similarly, food placed outside refrigerator should also be separated (raw and cooked). ▪ Avoid pouring liquids used for marinating raw meat over cooked food.

Additional Information

- Emphasize that separation must occur not only when cooking, but during all phases of food preparation including slaughtering processes. Liquids used for marinating raw meat should not be poured over the meat when it is cooked and ready to eat. “Cross-contamination” is a term used to describe the transfer of microorganisms from raw to cooked food.
- Be sure not to place hot food in plastic bags, as this can cause harmful chemicals to migrate from the plastic into the food.

KEY 3 COOK THOROUGHLY



Rationale **Proper cooking can kill almost all dangerous microorganisms. Studies have shown that cooking food to a temperature of 70 °C can help ensure it is safe for consumption. Foods that require special attention include minced meats, rolled roasts, large joints of meat and whole poultry.**

Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Cook food thoroughly especially meat, poultry, eggs and seafood	Proper cooking kills dangerous microorganisms, ensuring food is safe to eat. Cooking to 70°C is recommended for most foods, including minced meats, large joints, and poultry.	▪ Use a thermometer where available, placing it in the center of the thickest part of the meat. ▪ If a thermometer is unavailable: o For poultry, ensure that the juices are clear and no longer pink. o For eggs and seafood, ensure they are cooked until piping hot throughout. o For liquids like soups and stews, bring them to a boil and continue boiling for at least 1 minute. o For larger pieces of meat, ensure that they are evenly browned, especially at the thickest part. You can cut a small piece from the center to check if it is properly cooked.
Ensure safe microwave cooking	Microwave ovens can cook unevenly, leaving cold spots where bacteria may survive. Some plastic containers can release toxic chemicals when heated.	▪ Ensure microwave-cooked food is evenly heated and piping hot throughout. ▪ Avoid using plastic containers not labeled as microwave-safe.
Check the cooking temperature	Food must reach a temperature of 70°C to kill harmful microorganisms, especially in minced meat and poultry, where bacteria can reside both on the surface and inside.	▪ Properly use a thermometer by placing it in the center of the thickest part of the food, ensuring it does not touch bone or container sides. ▪ If a thermometer is unavailable: o For poultry, juices should run clear, and the meat should not be pink. o For liquid-based foods, boiling for 1 minute ensures sufficient heat throughout. o For seafood and eggs, they should be cooked until piping hot, with no translucent parts remaining.

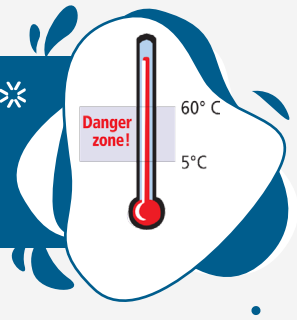
Reheat cooked food thoroughly	Reheating ensures any bacteria that may have grown during storage are killed. Food should be reheated until it is piping hot throughout.	▪ When there is no thermometer, rely on visual cues to ensure food is piping hot throughout. ▪ Reheat liquids by bringing them to a boil again. For solid foods like meat, ensure even heating by stirring or cutting into the food to check if it is hot throughout.

Additional Information

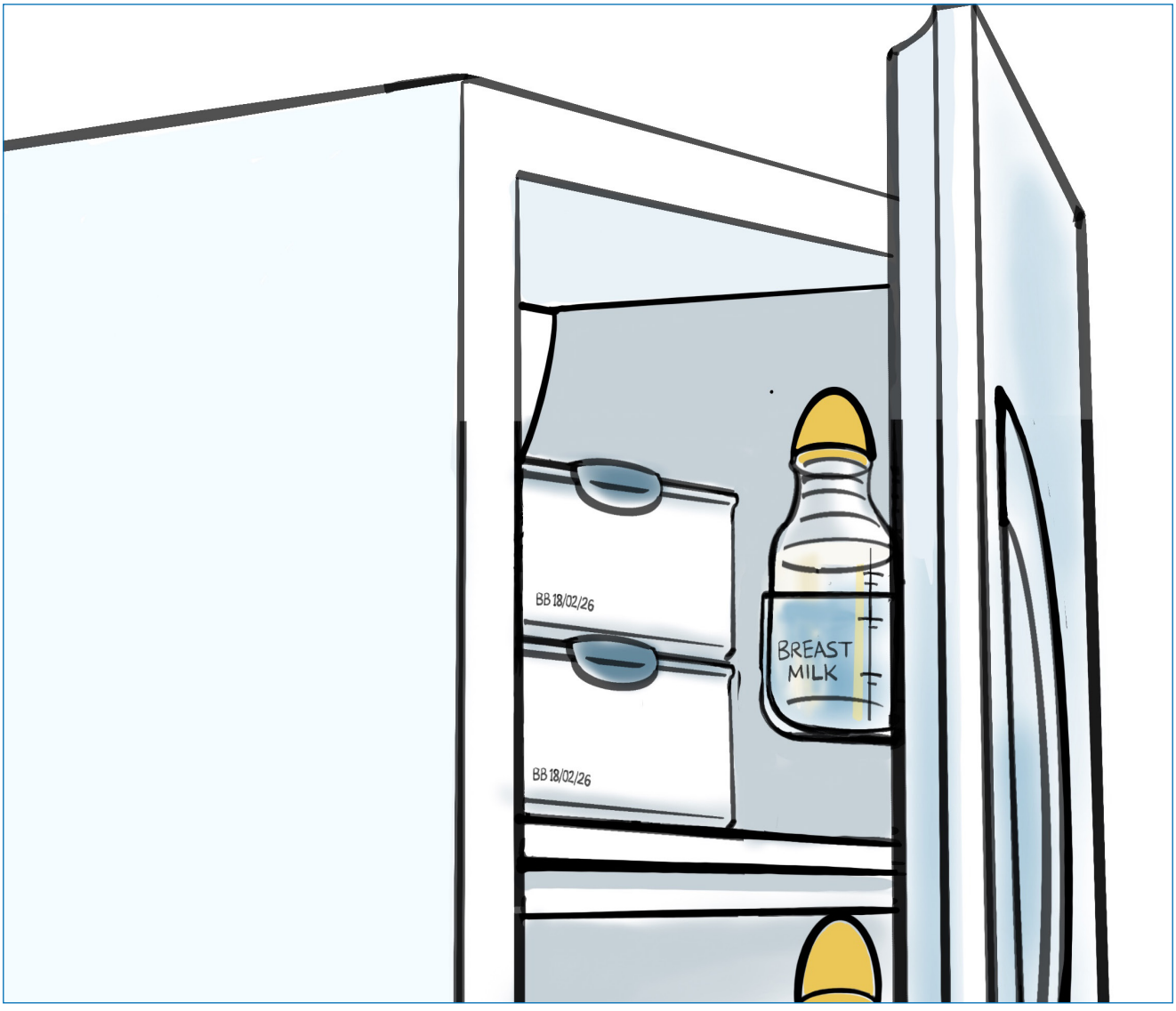
The centre of an intact piece of meat is often sterile. Most bacteria are on the outer surface. Eating intact pieces of meat (e.g. roast beef) with red centres is usually not dangerous. However, in minced meat, rolled roasts or poultry, bacteria can be found both outside and in the centre.

- Lower cooking temperatures can be used to kill microorganisms in certain foods. With lower temperatures, more cooking time is required.
- Reheat cooked food until it is piping hot throughout.
- Avoid overcooking eggs and vegetables to preserve their nutrients.

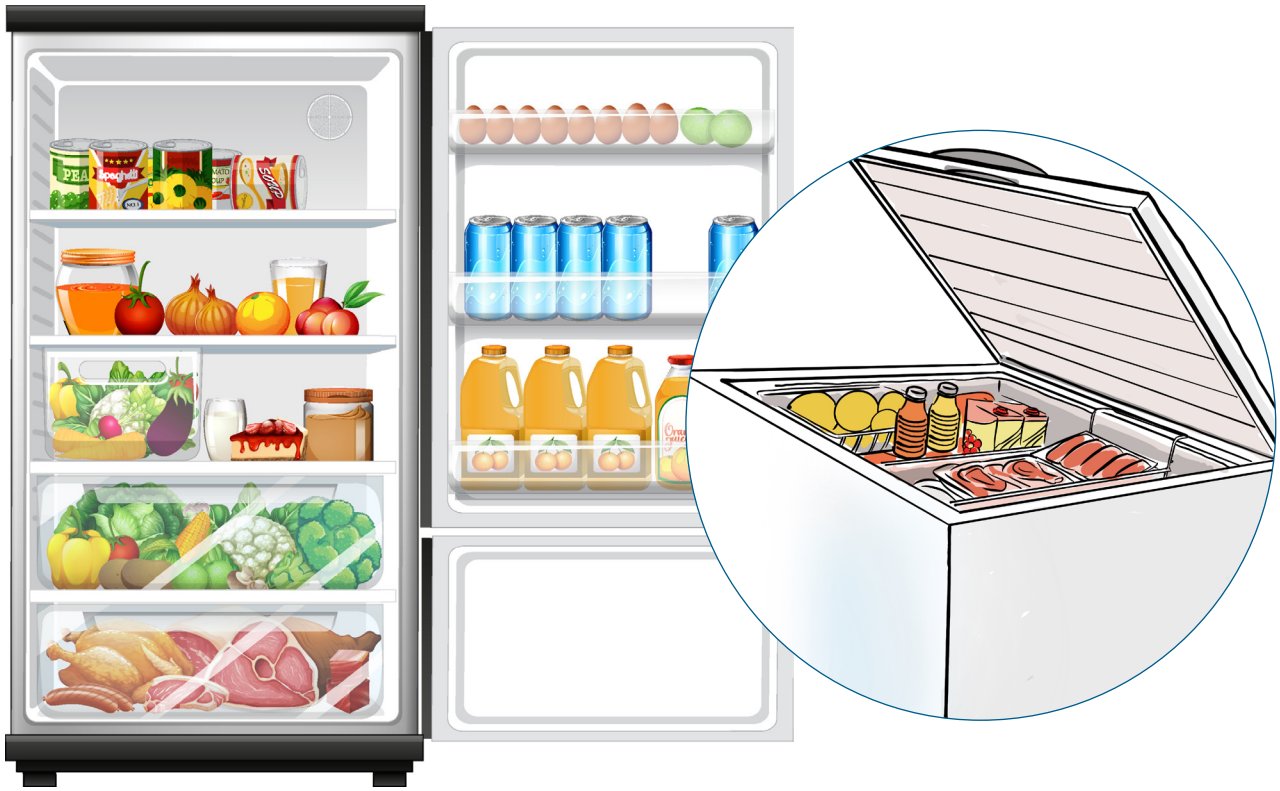
KEY 4 STORE FOOD SAFELY



Rationale **Microorganisms can multiply quickly if food is stored at room temperature or retains too much moisture. Preservation techniques focus on reducing water activity, alongside controlling temperature, to slow or stop the growth of harmful microorganisms. Reducing water activity through methods such as dehydration, salting, and fermentation is essential in preventing bacterial growth and food spoilage.**



Refrigeration and freezing



Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Refrigerate promptly all cooked and perishable foods at temperatures < 5°C.	Low temperatures slow microbial growth, preserving the food's safety and extending its shelf life.	Store perishable foods in a refrigerator as soon as possible after purchase or cooking. Use a refrigerator thermometer to confirm that the temperature stays below 5°C.
Limit storage time, even in a refrigerator. Cooked food should be consumed or preserved within 3 days.	Some microbes grow slowly even when food is refrigerated. Limiting storage time reduces spoilage risk.	Label containers with the date of storage and set reminders to consume, preserve or dispose of cooked food within 3 days.
Do not thaw frozen food at room temperature. Always thaw food in a refrigerator or another cool place.	Thawing food at room temperature encourages bacterial growth on the food surface. Thawing in the refrigerator maintains a safe temperature throughout the process.	Plan ahead to allow enough time for food to thaw in a refrigerator. Alternatively, use a cold-water bath or microwave to speed up the process while keeping the temperature safe. Food thawed in a microwave oven should be cooked promptly.

Storage at Ambient Temperature

Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Obtain fresh food daily and prepare only what is needed.	Without refrigeration, fresh food has a short shelf life.	Purchase fresh food in small quantities, plan meals carefully, and prepare portions that match immediate consumption needs. Avoid leftovers when refrigeration is not available.
Smoke meats and fish to preserve them.	Smoking introduces anti-microbial compounds while simultaneously drying the food at a temperature high enough to restrict or prevent microbial growth.	Smoke food at low temperatures using wood chips or charcoal in a smoker. Ensure the food is cured or brined beforehand. Store in a cool, dry place after smoking.
Ferment foods like vegetables (e.g., pickles or kimchi) and dairy (e.g., yogurt).	Fermentation usually lowers pH and may create an atmosphere lacking O2, that restricts or prevents harmful microbial growth.	Use appropriate starter cultures or naturally occurring microbes. Follow tested recipes to ensure the right balance of ingredients and storage conditions for fermentation.
Marinate food in acidic solutions, e.g., vinegar.	Acidic solutions inhibit the growth of spoilage microorganisms.	Prepare acidic marinades with vinegar or citrus juice and submerge the food for sufficient time. Keep the food covered and, when possible, refrigerated during marinating.
Can food in jars	Canning removes air required for microbial growth on both refrigerated and dried foods.	Sterilize jars for canning by placing them in boiling water before filling them. Ensure a tight seal after processing. Store sealed foods according to their type (refrigerated or shelf-stable).

Do not leave cooked food exposed for long periods of time (consume within 2 hours at room temperature).	Microorganisms multiply rapidly at ambient temperatures. Eating within 2 hours reduces microbial growth risk.	Set timers to track how long food is exposed. Cover food when it is left out and refrigerate leftovers promptly.
Dehydrate/dry foods such as vegetables, fruits, fish and meats to reduce moisture.	Removing water lowers food's moisture and inhibits the growth of bacteria, molds, and yeasts.	Use solar dryers, electric dehydrators, or simply dry food in the sun. Ensure that food is dried thoroughly and stored in airtight containers to prevent moisture reabsorption.
Salt meat, fish, and vegetables to sequester moisture and inhibit microbial growth.	High levels of salt create environments that draw moisture out of microbes and stops them from growing.	Rub salt evenly on the surface of the food or submerge the food in brine. Store treated food in a cool, dry place to increase effectiveness. **Note:** This method is not recommended for individuals with high blood pressure for whom excessive sodium intake may pose a health risk.
Smoke meats and fish to preserve them.	Smoking introduces anti-microbial compounds while simultaneously drying the food at a temperature high enough to restrict or prevent microbial growth.	Smoke food at low temperatures using wood chips or charcoal in a smoker. Ensure the food is cured or brined beforehand. Store in a cool, dry place after smoking.
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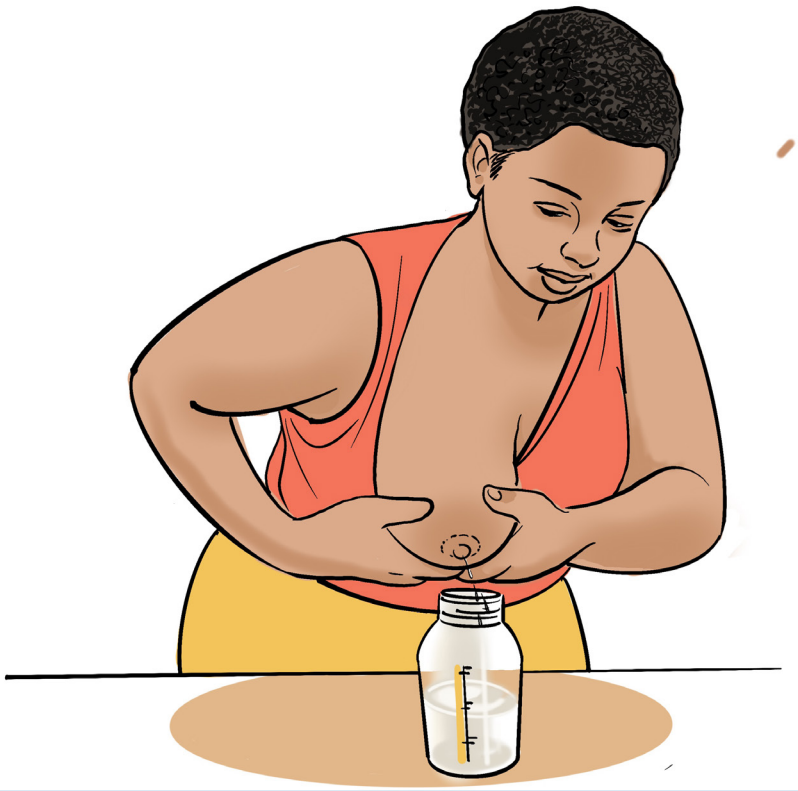
Recommendations for Safe Breast Milk Storage



Recommendations (What?)	Reasoning behind the recommendation (Why?)	Actionable Steps to Achieve the Recommendations (How?)
Keep expressed breastmilk in the refrigerator for up to 4 days, in a freezer for up to 6 months.	Properly storing expressed breast milk at the right temperatures stops bacteria from growing and keeps the nutrients intact	▪ Choose a suitable container made of glass or plastic that can be kept covered to be used for expressing breast milk. ▪ Clean it by washing in hot soapy water, and rinsing in hot clear water. ▪ If storing several containers, each container should be labeled with the date. Use the oldest milk first. ▪ Frozen breast milk may be thawed slowly in a refrigerator and used within 24 hours. ▪ It can be defrosted by standing in a jug of warm water and used within one hour, as it is warm
Store expressed breast milk in clean, airtight containers at room temperature for up to 4 hours	Beyond this time frame, the risk of bacterial growth increases, which can compromise the milk's safety and nutritional value	▪ Select an appropriate glass or plastic container with a lid for expressing breast milk ▪ Clean it by washing in hot soapy water, and rinsing in hot clear water

Keeping food in a warmer

Keep cooked food piping hot (> 60°C) if storing for immediate consumption.	Food at > 60°C does not support microbial growth in the "danger zone" between 5°C and 60°C.	Use a food thermometer to ensure hot food stays above 60°C. Cover food and keep it in an insulated container if it needs to stay hot for an extended period of time.

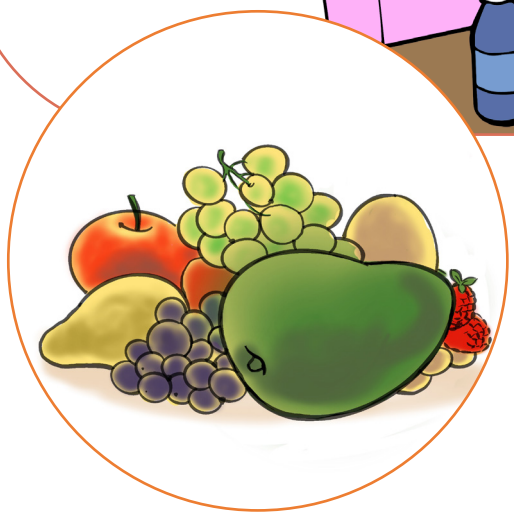
Considerations and Suggestions for the Trainer

1. **Storage Practices**: Food storage methods can vary significantly depending on the region and the resources available. Trainers should familiarize themselves with the local food storage practices before offering suggestions. During training, it is important to discuss safe storage practices and explain why certain techniques are effective in preventing foodborne illnesses. This includes addressing both refrigerated and non-refrigerated storage methods.
2. **Provide Local Context for Refrigerated Foods**: In areas where refrigeration is available, trainers should offer clear guidelines on safe refrigeration times for commonly consumed foods. Providing a list of storage times based on locally available refrigerated foods will help participants ensure their food is stored safely.
3. **Handling Fresh Food When Refrigeration is Limited**: In regions where refrigeration may not be feasible, trainers should emphasize the importance of using fresh food as soon as possible after purchasing or harvesting. The option to acquire fresh food daily and cook only what is necessary can reduce the risk of food contamination and spoilage.
4. **Thawing Large Meats Safely**: When discussing the safe thawing of large meat products (e.g., full chicken), it is critical to provide guidance on how to do this safely. Thawing should always be done in the refrigerator or using cold water to prevent bacterial growth. Discussing proper thawing techniques ensures that participants know how to handle large cuts of meat without risking contamination.
5. **Understanding Safe Food Temperatures**: Trainers should explain the concept of the "danger zone," which is the temperature range between 5°C and 60°C, where microorganisms can multiply rapidly. It is essential to maintain food outside this range by keeping it either hot or cold. This will help prevent the growth of harmful bacteria.
6. **Cooling Food and Storing Leftovers**: Trainers should offer practical tips for cooling food quickly and storing leftovers safely. For example, large portions of meat can be sliced into smaller pieces, and soups can be stirred regularly to speed up cooling. Leftovers should be stored in the refrigerator for no more than three days and should not be reheated more than once.

KEY 5

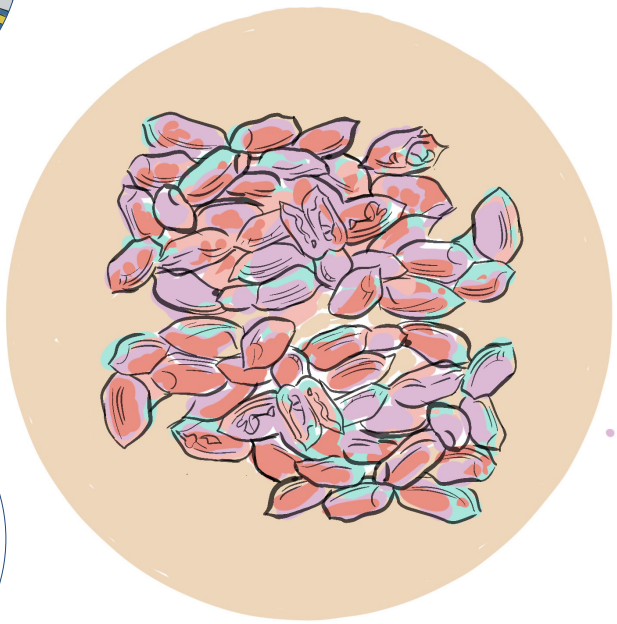
USE SAFE WATER AND RAW MATERIALS

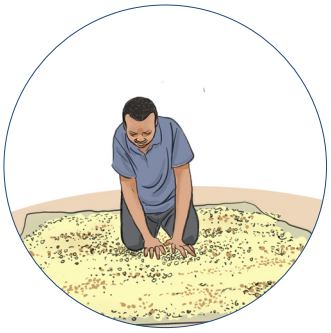
Rationale Raw materials, including water and ice, may be contaminated with dangerous microorganisms and chemicals. Toxic chemicals may be formed in damaged and mouldy foods. Care in selection of raw materials and simple measures such as washing and peeling may reduce risk.



Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Always use safe running water for washing fruits and vegetables, making food, making drinks, and cleaning cooking utensils.	Water can be contaminated with dangerous microorganisms (like parasites or pathogens) that cause diseases such as diarrhea, typhoid, and dysentery. Chemicals and toxins can also be present in untreated or polluted water, posing health risks.	▪ Safe water includes treated water (through boiling, chlorination, or filtration). ▪ To disinfect water: • Bring it to a rolling boil; • Add 3-5 drops of chlorine per liter; • Use an appropriate filter to remove pathogens. ▪ Ensure storage tanks are protected from contamination, especially by animals or insects (like mosquitoes).
Select Fresh and Wholesome Raw Materials	Raw materials like fruits, vegetables, and other foods can carry harmful bacteria and toxins, especially when damaged, spoiled, or not stored properly. These contaminants can cause foodborne illnesses.	▪ Choose fresh, undamaged, and wholesome foods. ▪ Discard damaged or bruised areas from fruits and vegetables. ▪ Avoid items displaying signs of spoilage, mold, or damage (detailed guidelines on the prevention and control of mold and mycotoxin contamination in agricultural products are provided below).
High-Risk Foods must be processed before consumption for Safety. This recommendation specifically applies to high-risk foods (meats, dairy), not to low-risk foods like fruits and vegetables, which can be consumed fresh if washed with safe water.	High-risk foods, such as meats and dairy products, can harbor harmful bacteria. Processing methods like pasteurization (for milk) and irradiation (for meats) are designed to kill these bacteria, significantly reducing the risk of foodborne illness when consumed.	▪ Opt for processed high-risk foods, such as pasteurized milk and irradiated meats, that have undergone treatments to ensure safety. ▪ When consuming unprocessed or raw high-risk foods (e.g., meat, poultry, dairy), ensure they are thoroughly cooked or properly treated to eliminate harmful microorganisms.
Wash Fruits and Vegetables Thoroughly	Even fresh produce can harbor harmful bacteria, pesticides, or other contaminants. Washing with safe water reduces these risks.	▪ Wash all fruits and vegetables under clean, safe water before consumption. ▪ Particularly focus on raw items (e.g., salads), as they pose a higher risk when consumed without cooking.
Avoid Using Expired Foods	Expired food can harbor dangerous levels of bacteria, toxins, or molds that develop over time, leading to food poisoning.	▪ Always check expiration dates on food packages and discard anything past the date. ▪ Avoid dented, swollen, or rusted cans, as these may indicate compromised safety.

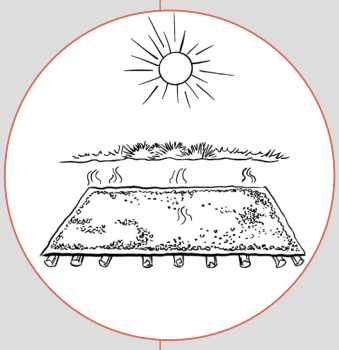
Effective Strategies for the Prevention and Control of Mold and Mycotoxin Contamination in Agricultural Products





Recommendations (What?)	Reasoning Behind the Recommendations (Why?)	Actionable Steps to Achieve Recommendations (How?)
Sustain plant's vigor and health 	Vigorous and healthy plants are more capable of resisting fungal infections, reducing the risk of fungal growth that can lead to mycotoxin production. A weakened or diseased plant is more susceptible to fungal attacks.	Timely plant agro-ecologically adapted varieties. ▪ Use sound seeds and plant disease-resistant/tolerant varieties. ▪ Maintain soil fertility by applying organic or inorganic fertilizers, manure, and/or follow integrated approaches like crop rotation. ▪ Maintain adequate soil moisture (irrigation or water conservation practices) during plant growth. ▪ Ensure proper plant spacing to avoid overcrowding. ▪ Use integrated pest management (biocontrol, minimal pesticide use) ▪ Control pests, weeds, and diseases through regular monitoring and timely intervention. ▪ Remove weeds and diseased plants promptly.
Reduce toxigenic fungal population in growing plants and in storage 	Some environments promote higher fungal populations, increasing the risk of mycotoxin contamination. Practices that limit exposure to fungi (both during growth and storage) significantly reduce the chance of contamination.	▪ Implement crop rotation and avoid monoculture. ▪ Use biological controls or appropriate fungicides where necessary ▪ Remove and burn diseased plants to prevent spread. ▪ Avoid produce coming into direct contact with the soil (use clean harvesting methods). ▪ Ensure storage facilities and bags are cleaned and disinfected before use. ▪ Apply fungicides in storage when required. ▪ For fruits and vegetables, avoid bruising and keep stored items dry and clean to prevent mold growth.

Rapidly reduce moisture content of crops and avoid rehydration	High moisture content and humidity are the primary factors promoting fungal growth, which in turn leads to mycotoxin production. Rapid drying and keeping food dry prevent fungal proliferation. This is critical for grains and legumes but also applies to many fruits and vegetables.	▪ Harvest at the right time (when crops or fruits are mature but not overripe or damaged). ▪ Dry crops (grains, fruits, and vegetables) rapidly and completely, as soon as possible after harvest. ▪ Store produce under dry conditions (ensure good ventilation, prevent leaks, avoid contact with walls or floors). ▪ Keep pests (rodents, insects) away from stored foods. ▪ Do not store food with water, animals, or in damp conditions. ▪ Use desiccants like calcium chloride ($CaCl_2$) to maintain low moisture in storage.



Safeguard outer layers, skins, and protective structures	The outer layers of crops (e.g., hulls, skins, seed coats) provide natural defense against fungi and bacteria. Damaged produce is more susceptible to fungal penetration, increasing the likelihood of mycotoxin contamination. This applies to both fresh produce like fruits and grains.	▪ Handle fruits, vegetables, and grains gently to avoid mechanical damage during harvesting, processing, or transport. ▪ Prevent insect or rodent attacks by using proper packaging and pest control measures. ▪ For fruits, ensure the skin is intact, and for grains, protect the seed coat or shell from damage. ▪ Use appropriate tools during harvest and transport to prevent physical damage.

Clean and remove mycotoxin high-risk components	Mycotoxins are often concentrated in the damaged or contaminated portions of crops, such as moldy or broken grains or bruised and spoiled fruits. Removing these high-risk components significantly reduces the overall mycotoxin load in stored food, improving safety and quality. 	▪ Sort and clean all produce to remove any diseased, moldy, or damaged components before storage. ▪ Sort grains and fruits to discard immature, shriveled, or broken pieces. ▪ Sieve and remove debris, dirt, and fine particles from produce partcularly grains. ▪ For fruits and vegetables, remove any visibly damaged, overripe, or spoiled items before storage or sale. ▪ Separate grains by density and discard lighter, moldy portions (e.g., floating grains).