GOOD HYGIENIC PRACTICES IN THE PREPARATION AND SALE OF STREET FOOD IN AFRICA

Tools for training

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ISBN 978-92-5-105583-0

Foreword

The Food and Agriculture Organization of the United Nations (FAO) has placed food security at the heart of its mandate and, through the Declaration of the World Food Summit held in November 1996, has reaffirmed the right of everyone to safe and nutritious food. Considerations of food safety and quality are now integral to that concept.

In collaboration with its member countries, other UN agencies, such as the World Health Organization (WHO), and national and international, governmental and non-governmental organizations, FAO has sought to improve the safety and quality of food products for over 50 years. This work applies to the whole food chain, from primary production, through processing, storage and transport, to marketing.

Throughout the years, FAO's Nutrition and Consumer Protection Division (AGN) has provided advice on strategies to improve the effectiveness of food control systems, covering both food safety and quality and, through a multitude of field projects, has helped disseminate the standards drawn up by the Joint FAO/WHO Codex Alimentarius Commission. It has also worked to strengthen national food control structures, to implement food safety assurance systems in small and medium enterprises, including the HACCP system, to train inspectors and to upgrade food control laboratories.

Recognizing the socio-economic importance of the informal street food sector, FAO has undertaken actions since the 1980s to improve the hygiene of food produced and sold on the street, using an integrated approach that embraces all the stakeholders, including vendors/handlers, consumers, municipal authorities, inspection services and local research and development institutions.

The first consideration in those actions is the informal nature of the street food sector which precludes a rigid approach based on repression. Indeed, the effective role of street food in responding to poverty cannot be ignored. The approach adopted has therefore privileged involvement and dialogue, based on the identification of locally experienced constraints and benefits, through socio-economic surveys, but also on local practices and conditions of hygiene and sanitation. This initial phase serves to produce a critical assessment and to propose actions that are tailored to reality and that underpin a policy of harmonious, integrated development of the sector by the local authorities, working in tandem with the different players.

An important component of related projects is training, whether of food vendors/handlers, inspectors or consumers. Such training can exist as awareness-raising, hands-on experience of new practices or more theoretical learning to give players the basic notions that will enable them to make their choices according to their circumstances.

AGN has implemented numerous projects in Africa during the last 15 years: in Benin, Burkina Faso, Cape Verde, Cameroon, Côte d'Ivoire, Democratic Republic of the Congo, Guinea, Guinea-Bissau, Morocco, Nigeria, Senegal, South Africa, Tanzania and Uganda.

Implemented together with the national and municipal authorities, those projects had the following objectives:

- to improve the conditions in which street food is prepared and sold;
- to strengthen the capacity of local authorities to control raw materials and prepared foods;
- to conduct more in-depth research on the street food sector: its socio-economic impact, the juridical framework and the hygienic and nutritional enhancement of the food;
- to raise vendor awareness of sanitation and food hygiene and to teach the nutritional value of foods through education and training;

- to share experiences and promote the formation of networks of local and national authorities at regional level in order to disseminate good practices and promote a common strategy;

- to raise consumer awareness of the nutritional and hygienic aspects of street food.

This manual collates the lessons learned from training given in such field projects. We hope that it will serve as a useful, practical reference tool that will help trainers to design their own workshops according context and target audience, and will thus promote street food that is safe and nutritious.

Ezzeddine Boutrif

Director, Nutrition and
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INTRODUCTION

IMPORTANCE AND CHARACTERISTICS OF THE STREET FOOD SECTOR

The street food sector offers ready-to-eat foods and beverages that are prepared and/or sold by itinerant or stationary vendors, especially on streets and in other public places. These foods account for a significant proportion of the daily urban food consumption of millions of low- and middle-income consumers. For many people with limited means, street foods are often the least expensive and the most accessible way of obtaining a nutritionally balanced meal outside the home, provided the consumer is informed and capable of choosing an appropriate combination of foods.

The preparation and sale of street food provides a regular source of income to millions of men and women in developing countries. However, their knowledge and expertise in food handling are often limited and they often engage in street food mainly to escape poverty, especially as little start-up capital is required. In Africa, the street food phenomenon has burgeoned in the last thirty years because of rural outmigration and urban population growth. The labour force has ballooned and commuting distances have increased, accentuating demand for ready-to-eat food near work. Street food is also able to provide outlets for urban and periurban agricultural producers and local food processors, thus contributing to local and national economic growth.

Today, local authorities, international organizations and consumer associations are increasingly aware of the socio-economic importance of street food but also of its associated risks. The main concern is food safety, although other problems exist, including sanitation (accumulation of waste on streets and blocked drains), congestion obstructing pedestrians (occupancy of pavements by hawkers and traffic accidents), the illegal occupation of public and private space and social problems (child labour, unfair competition for the formal trade sector).

The risk of food poisoning from street food remains a threat in many parts of the world, especially microbiological contamination. Foodborne pathogens pose a serious health hazard, essentially determined by type of food and method of preparation and preservation. One clear factor of risk is vendor ignorance of the causes of foodborne diseases. The risks to public health are exacerbated by poor hygiene, inadequate access to clean water and waste disposal, and unhealthy surroundings (proximity of drains and public discharge sites). The improper use of additives (often unauthorized colouring agents), mycotoxins, heavy metals and other contaminants (pesticide residues) are additional street food hazards.

Finally, while many consumers claim to consider hygiene when selecting their street food provider, they are often unaware of the associated health risks.

AIMS OF THE MANUAL

FAO proposes technical assistance to help national and municipal authorities to ensure the safety and quality of street food. As most itinerant vendors have received no training in food hygiene or sanitation and have to work under difficult and unsanitary conditions, FAO focuses on awareness raising and training of stakeholders in this complex system: handlers, vendors, consumers, official inspectors, representatives of associations or non-governmental organizations (NGOs), and so forth. As in any food preparation activity, it is important to know and apply the basic rules of food hygiene. FAO's assistance programmes emphasize the practical implementation of the Codex Alimentarius guidelines, especially the general principles of food hygiene and analysis of critical control points applied to street food, together with revised regional guidelines for measures to control street food in Africa.

This manual therefore collates accumulated experience in the training of informal street food operators in Africa. It sets out to cover gaps in basic theoretical knowledge, to explain the sources of contamination in food and the food processing chain, and to provide information and know-how appropriate to the constraints of the sector.

Accumulated experience from field activities has identified the following key factors in street food contamination:

- Poor conditions of storage of raw materials and finished products (exposure to dust, insects, pests, etc.).
- Insufficient cleaning of raw materials, ingredients and utensils before cooking, and of tableware used by customers.
- The use of utensils (saucepans and other recipients) likely to release toxic or dangerous substances into the food.
- Inappropriate handling of ingredients and raw materials, of food during preparation and of finished products.
- The prolonged holding of prepared food at inappropriate temperatures.

Designed in modular form, linking basic information with multiple illustrations and practical fact sheets, this manual aims to serve as a resource tool for trainers addressing different audiences: handlers, vendors and consumers, NGO agents and other support bodies active in the street food sector, hygiene inspectors and technicians specialized in food technology and nutrition. The training can be trainer training (representatives of vendor or consumer associations, relevant NGO agents) or direct training (inspectors, producers and vendors).

The manual centres on the five core sources of contamination (raw materials, environment and equipment, workforce and methods) and provides more details in areas considered relevant to street food: basic information to understand microbiological contamination, water and critical control points during food preparation, with an emphasis on those stages where corrective action can be instrumental, in order words adopting a risk-based approach.

These aspects are in Section I, which is supplemented with illustrations. These are designed to facilitate direct training activities and to supplement the text, which is geared more towards helping trainer trainers to devise their training programmes.

Section II proposes pedagogical tools and provides a narrative to help trainers design their programmes and tailor their training activities to the street food context.

Finally, Section III provides a series of technical fact sheets as technical support and as material to help answer the many concrete problems raised by participants (cleaning methods, hygienic transport of street food, etc).

Section I

MODULE 1

CONTAMINATION OF STREET FOOD

PLAN

TRAINING OBJECTIVE

The objective of this module is to provide street food players with basic notions, understanding and information on the causes of street food contamination and hazards to the consumer.

The module looks primarily at the microbial contamination of food and, to a lesser degree, to contamination from physical and chemical agents. This is not to say that the physical and chemical risks are unimportant, but we need to consider that:

- foreign substances can often be more easily spotted by the handler/vendor and therefore more easily eliminated;
- chemical contamination is often linked to raw materials that are already contaminated and over which the food handler has little control, apart from trading with "reliable" suppliers;
- contamination of microbial origin is usually invisible, but the food handler can significantly reduce such contamination through behaviour; hence the impact of training.

ON COMPLETION OF THIS MODULE, STREET FOOD HANDLERS/VENDORS AND OTHER PLAYERS SHOULD:

- know the main types of microorganisms responsible for food contamination and the factors and conditions that facilitate their presence and growth;
- be able to describe the major types of contamination that can affect food products and the resulting risks and harmful effects for consumers;
- be familiar with most forms of street food contamination by microorganisms harmful to humans and reduce their effects to a minimum.
- know the other forms of possible street food contamination and the physical and chemical agents responsible and associated risks;
- understand the consequences of inadequate hygiene during street food preparation, preservation and sale;
- understand the basic notions of the faecal hazard;
- be able to implement the actions, practices and behaviour needed to maintain and improve the sanitary quality of product during street food preparation and sale.

KEY WORD

Contaminant - Food – Infection – Toxin – Toxic infection - Food poisoning
Proliferation – Microbe – Morbidity - Mortality

1.1. 1.1 MICROBIAL CONTAMINATION OF STREET FOOD

Beyond plants and animals, there is also a vast population of living organisms that cannot be seen with the naked eye: these are microorganisms. Some are dangerous to humans when they colonize and grow on the food that we eat.

A. CLASSIFICATION OF MICROORGANISMS

Microorganisms exist everywhere, in every environment, in water, in air, in soil, and in the food we eat. They can only be seen through a **microscope (Illustration 1-1)**.

Microorganisms are usually classified into five major categories depending on their shape, size and form of life: bacteria, yeasts and moulds, viruses and protozoa.

A.1. Bacteria

Bacteria exist as individual cells or group of cells, all identical and interrelated in colonies. They are measured in micrometres (thousands of a millimetre). They exist in various shapes and also belong to several families with different traits. They can sometimes live and grow in nutritiously poor environments, including water. Others are more demanding and only grow in rich environments, such as milk, meat, prepared food, blood, and animal or human intestine. Some bacteria are useful for processing food; they cause fermentation as with yoghurt (lactic bacteria). Others have undesirable effects on food, producing gas, disagreeable odour, change in flavour. Still others are dangerous to consumer health and are known as **pathogenic bacteria**.

LEARN MORE

Bacteria can be grouped into four major families: coccus (spherical in shape, sometimes clustered like bunches of grapes), bacillus (in the form of rods), spirillum (in the form of spirals) and vibrio (curved).

Under ideal conditions, each bacterium divides in two every 20 minutes. Thus, after 8 hours, a bacterium has produced 16 000 000 bacteria. Microorganisms therefore multiply very quickly. The risk of food deterioration from microorganisms therefore increases very rapidly.

Under certain conditions (rarefaction of nutrients required for cell life) some bacteria, like *Clostridium and Bacillus spp*, can produce spores as a form of cell survival very resistant to heat and pH extremes, for example. The spore remains dormant until conditions for growth return, when it will germinate into bacterium of "normal" shape.

DESCRIPTION

A laboratory technician examining a microscope sample of food contaminated by microbes.

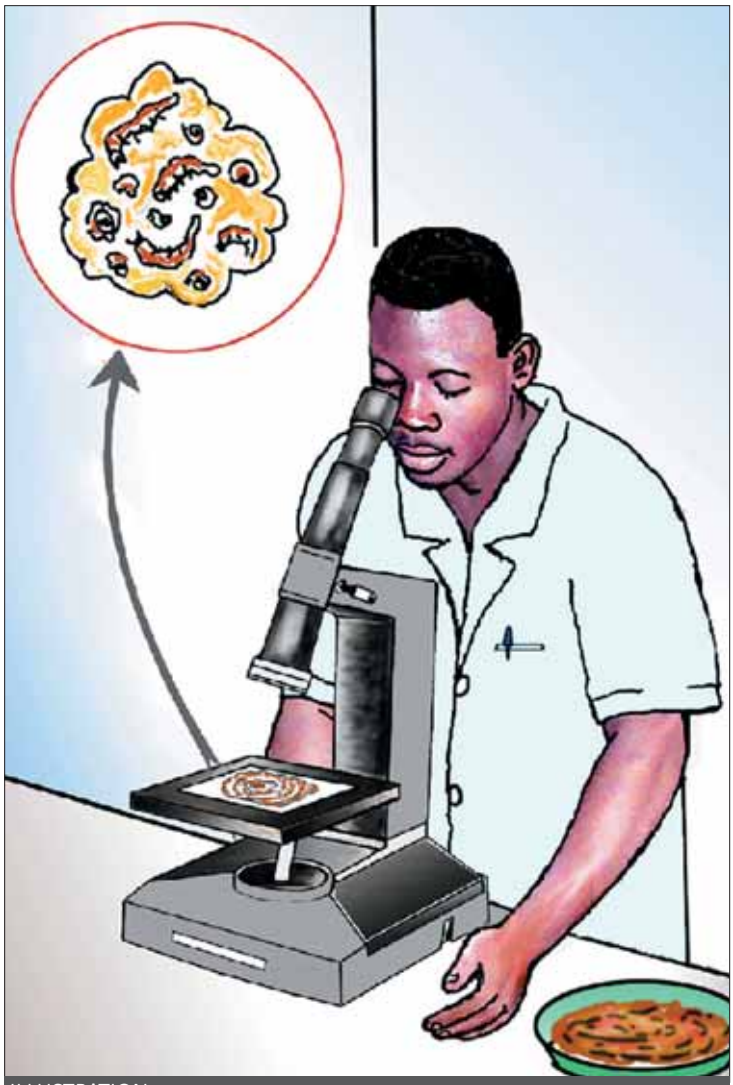


ILLUSTRATION 1.1

MESSAGE

Let's avoid contact between food and dirty environment (water, air, ground) to prevent contamination by microbes invisible to the naked eye.

A.2. Yeasts

Yeasts are made up of isolated oval or round cells measuring 3 to 10 micrometres in diameter, and therefore more than 10 times the size of bacteria. They essentially reproduce through budding.

Yeasts develop either on the surface or inside foods (solid or liquid environments). Some yeasts are cultivated industrially and commercialized for their specific properties of fermentation of sugars and partial transformation of these into alcohol and gas (production of beer and other fermented alcoholic beverages, production of bread using baker's yeast). Yeasts do not generally pose any danger to health, although some taint food and render it unfit for consumption.

A.3. Moulds

Moulds are microbes made up of several cells. They are referred to as microscopic fungi or mycetes. Their constituent cells are linked to each other by thin branching filaments called "mycelium". The mycelium attaches to the host medium (food, hides, fabrics, floors, walls, plants, human and animal skin) and its aerial part produces specialized reproductive cells. Moulds need air to develop. They exist as blotches of differing size and colour.

Moulds are used in industry, notably to produce antibiotics. But some cause disease in humans and animals through the toxins (called mycotoxins) that they produce, and are therefore a risk to public health. A case in point is Aspergillosis (*Aspergillus flavus* and close strains) which produces mycotoxins called aflatoxins. Aflatoxins are seriously hepatotoxic and hepatocancerogenic (hepatic tumours or primitive cancer of the liver). Moulds are unfortunately resistant to heat and relatively insensitive to antiseptics. Any food carrying mould can be a source of contamination, like groundnut and other oilseed grains, maize, liquid or powdered milk and other dairy products.

A.4. Viruses

Viruses are much smaller than bacteria. They are only visible with a very powerful microscope, called an electronic microscope. Viruses are unable to reproduce when isolated. They can only multiply when they have penetrated another living cell whose energy and metabolic pathways they use: they are obligatory intracellular parasites. Viruses are parasites on both animals and humans.

Many cause relatively serious diseases such as viral hepatitis, measles, smallpox and rabies. For example, hepatitis A or endemic hepatitis is transmitted by water or by food that has undergone rapid superficial heat treatment (boiled egg, frozen, dried, undercooked and insufficiently reheated food). Seashells, flies, dirty hands and anything that has come into direct or indirect contact with the stool of carriers are also possible channels of transmission. The infectious agent is a virus that penetrates orally, enters the blood and settles in the liver. Sickness can be serious, especially during pregnancy. After a possible phase of jaundice, it can lead to cirrhosis of the liver.

A.5. Protozoa

Protozoa are microorganisms belonging to the animal kingdom. They have a single cell and are capable of displacement in liquid environments. Many are parasites in humans and animals. They are characterized by an ability to change into cysts or other forms of resistance.
Protozoa are responsible for some very serious illnesses, including intestinal disease like giardiasis and amoebiasis. In the case of amoebiasis, when the cysts penetrate our digestive tract through consumption of raw vegetables, the amoebae regain activity and rapidly multiply provoking dysentery, a condition characterized by frequent passing of bloody stool.
Giardiasis is a very common parasitic infestation in the world, causing loss of appetite, abdominal cramps, bloating, passing of gas, nausea and even vomiting. The agent responsible for the disease is *Giardia lambilia*. Epidemics normally arise from surface waters and the foods most commonly infected by this parasite are fruit salads, sandwiches, fresh vegetables and raw milk. Transmission is faecal or oral.

B. PHYSICAL AND CHEMICAL FACTORS INFLUENCING THE GROWTH OF MICROORGANISMS

Some factors influence the growth of microorganisms. To prevent or curb their development, which can spoil food and be harmful and dangerous to human health, it is important to understand the factors that facilitate their development or permit their destruction. The most important factors are: temperature, water, presence of oxygen, acidity and chemical composition of the environment.

B.1. Temperature

Many microorganisms are destroyed by high temperatures. Microbes can be classified in three groups, according to temperature conditions for their development:

- Those that "prefer" a low temperature of between -7 °C and +10°C are known as psychrophilic and psychrotrophic microorganisms. These can taint refrigerated foods, especially meat, poultry, fish and dairy products;
- Those that "prefer" medium temperatures of between 20 °C and 40°C (known as mesophile organisms that can grow at ambient temperature);
- Those that "prefer" high temperatures of between 45 °C and 65°C (known as thermophile microorganisms that are most likely to survive incomplete heat treatment).

In many cases, preparing and cooking food properly controls and reduces microorganisms, as most are destroyed by temperatures over 70°C. It is important however to remember that spores, the form of resistance of certain bacteria, can survive such temperatures and subsequently regenerate as pathogenic microorganisms.

B.2. Water

Microbes need water to live and develop. Foods contain varying quantities of water, depending on their type and nature. Foods of animal origin contain sufficient water for all microbes to develop and multiply.

LEARN MORE

WATER ACTIVITY

Water in plant or animal tissues varies in "availability". Measurement of this availability of water in different foods is given by the value of water activity (aw) determined by ratio.

$$a_w = Pw/P°w$$

where:

Pw = partial pressure of water vapour of a solution or food;
P°w = partial pressure of pure water vapour at the same temperature.

Depending on their availability in food, we distinguish two types of water: 'free' water and 'bound' water.

Bound water is retained by the molecular constituents of cells and thus unavailable for chemical reactions. Free water represents the bulk of water in fresh foods and foods that have been processed but not dehydrated. This is water available for chemical and microbiological reactions. It is responsible for the growth and multiplication of all microbes present in food. It can thus be the cause of food spoilage, contrary to the case of bound water. A high **aw** value indicates a high quantity of free water. It is therefore important always to reduce the **aw** to protect food. This means converting free water into bound water, for example by adding salt or sugar to a product. We can also reduce the **aw** by drying foods, adding gelatine or vegetable gums, or by crystallizing the water in food as ice (frozen products). The resulting food will have an **aw** of less than 0.9 and therefore be conducive to microorganism growth. This explains why these methods are used for food preservation.

In practice, the **aw** of a food placed in a sealed environment corresponds to the partial pressure of water vapour exercised by the food, hence the following approximation:

aw = **Equilibrium relative humidity** (in percentage) **/100**

B.3. Oxygen

The presence or absence of oxygen is another factor of microbe growth. Microbes can be classified in three groups: those that require oxygen to multiply, the "aerobic" microbes (e.g. *Bacillus*); those that cannot grow in the presence of oxygen, the "anaerobic" microbes (e.g. *Clostridium*); and those that are capable of growth under varying conditions of oxygenation, the "optionals". There is generally a mix of these three types of microbe in food, existing in perfect symbiosis. Their combined action can produce unfortunate effects on fruit juices, canned vegetables and other products because of significant gas production that causes spoilage and sometimes the explosion of canned goods.

B.4. Acidity of environment

The acidity of food products (measured by pH or concentration of hydrogen ions) is a determinant of microbe growth. Foods are classified as highly acidic (fruits and fruit juices: tomatoes, oranges, lemons), acidic (fermented maize dough, fermented cassava dough, sour cream) and non-acidic (meat, fish, eggs, oilseeds, fresh milk) according to whether their pH is below, equal to or above 4.5. Pathogens do not develop in highly acidic foods, but can survive.

LEARN MORE

A solution is chemically neutral when its pH is equal to 7; acidic when its pH is below 7 and basic when its pH is above 7. The lower the pH of a product, the higher its acidity. Acidic or basic products are more stable than neutral products. Products with a good shelf life (therefore stable) generally have a pH below 4.5, as in the case of fizzy drinks, fruits and fermented milks.

B.5. Chemical and nutritional composition of the environment

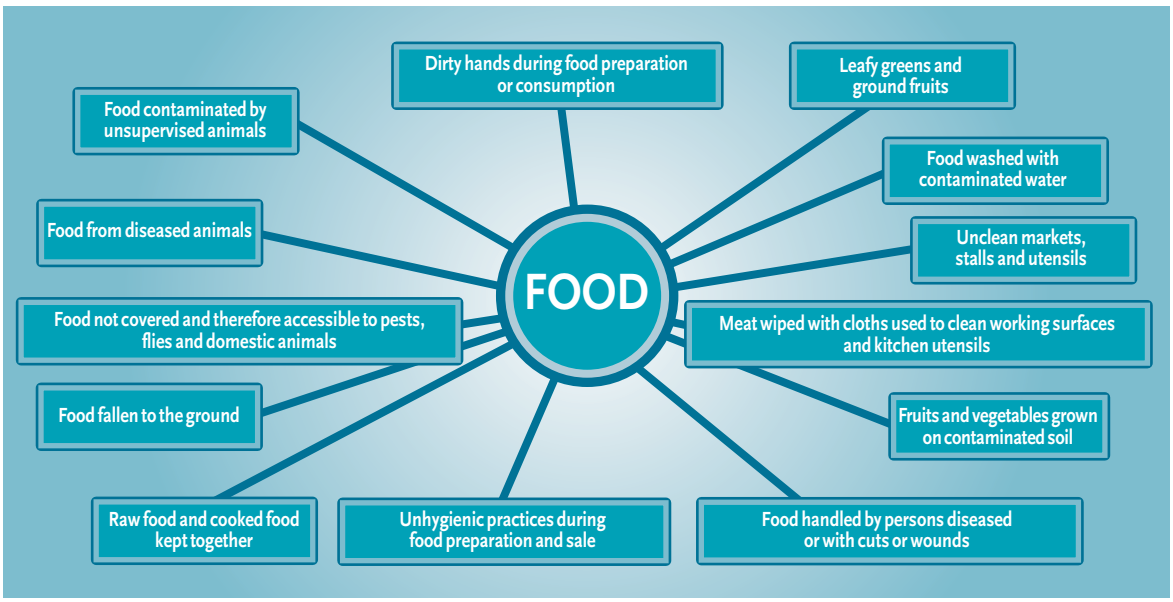
As with all living beings, microorganisms need nutrients to grow. The chemical composition of food is therefore an important determinant of inhibition or growth. The richer the food is in nutrients (proteins, glucids, vitamins and mineral salts) and water, the greater the potential for microorganism development; thus the higher the risk of food spoilage and contamination; and consequently the greater the hazard for consumer health. Most pathogenic microbes are demanding, but many germs are also capable of spoiling food that is very poor in nutrient content.

C. MICROBIAL CONTAMINATION OF STREET FOOD: ORIGIN AND CONSEQUENCE

The presence of microorganisms in street food (prepared dishes, snacks, etc.) can be the result of contamination of the raw materials used for food preparation or of insufficient protection of the food during preparation and/or holding until consumption. The raw materials used to prepare food are sometimes dirty, causing microbial contamination when cooking conditions are inadequate or ineffective. A major cause of microbial contamination of raw plant materials (ground fruits, leafy greens) is untreated human or animal organic fertilizer. Conditions are aggravated when these are not properly washed in clean water. Drinking water and ice sold on markets and streets are often contaminated with pathogenic germs, causing an array of diseases, including cholera.

The following diagram indicates how food can be contaminated.

Different causes of food contamination



Diseases from the consumption of contaminated food vary according to microorganism and level of contamination. Such food-borne microbial diseases can affect one or several persons at the same time. They exist as infectious disease, parasitic disease and food poisoning. There are four categories of food-borne microbial disease:

- disease resulting from the presence of bacteria in food or multiplication in the intestinal tract of the consumer (infection), such as typhoid fever (caused by a *Salmonella*); this is also the case for coliforms, campylobacters, etc.;

- disease such as botulism, caused by the presence in food of toxins secreted by certain bacteria (food poisoning); such is the case of *Staphylococci* and *Clostridia*;

- disease caused by the presence of parasites (toxic infection) as in the case of ingestion of beef or pork with tapeworm or vegetables contaminated by dirty water or faecal matter rich in amoeba and roundworm;

- disease caused by natural poisons (food poisoning), such as mushrooms.

Foods commonly contaminated include dairy products (yoghurt, curdled milk), cooked dishes, sauces, raw vegetables, sandwiches, mayonnaise, animal products (meat, fish, shellfish), fritters and cakes. Water, ice and traditional beverages are also subject to microbial and parasitic contamination.

The following "learn more" table associates principal microbial disease with type of food consumption.

The purpose of food hygiene is to safeguard the food by preventing or reducing its contamination by microorganisms or parasites from water, air, flies, insects and pests. Food hygiene serves to ensure the safety and sanitary quality of food.

Microorganisms exist in water, air and soil but also in faecal matter that can contaminate water or soil. Faecal matter contains microorganisms and is thus also a source of many diseases.

LEARN MORE

Principal microbial and viral diseases associated with food consumption

DISEASES	MICROORGANISMS RESPONSIBLE	SOURCES	VECTOR FOODS
Botulism	*Clostridium botulinum*	Soil, water, intestinal tract of animals	Poorly sterilized pH>4.5 canned food, fish, salt cured food without nitrites, vacuum-packed food or food in oil
Typhoid fever	*Salmonella typhi*	Healthy carriers, faeces of diseased humans, water	Food rich in proteins (meat, egg, fish, milk), raw produce, shellfish
Dysentery	*Shigella dysenteria, S. Sonnei, S. Flexner*	Faeces of the sick, water	Raw food, vegetables, salads, milk, water
Cholera	*Vibrio cholerae*	Faeces and vomit of infected persons, water	Raw food, vegetables, water
Malta Fever (brucellosis)	*Brucella melitensis*	Infected animals	Sheep milk and uncured cheese
Tuberculosis	*Mycobacterium tuberculosis, M. bovis*	Secretion of sick persons, animal milk	Raw milk in particular
Listeriosis	*Listeria monocytogenes*	Tissues, milk, urine of sick animals	Milk, milk products, meat, poultry
Intestinal anthrax	*Bacillus anthracis*	Sick animals	Raw meat, cold cuts
Tularaemia	*Francisella tularencis*	Blood and tissue of sick rabbits and hares	Rabbit and hare meat
Enteritis necroticans	*Clostridium perfringens C*	Animal faeces	Cooked meat and fish
Yersiniosis	*Yersinia enterocolitica*	Soil, water, animals (pigs)	Raw vegetables, meat, raw milk, water
Infection from Campylobacter spp	*Campulobacter jejuni*	Sick animals	Water, raw milk, chicken, shellfish
Salmonellosis	*Salmonella typhimurium, S. heldelberg, S. java, S. enteridis, S. montevideo, S. panama, etc.*	Faeces of domestic animals Skin, acne, nasal secretions	Meat, poultry, shellfish, fish, milk, eggs
Staphylococcal Enteroxicosis	*Staphylococcus aureus*	Skin, acne, nasal secretions	Ham, meat, poultry, crustaceans, cheese, milk, cold cuts, salads, pastries
Enterobacterial infections	*Escherichia coli* (several serotypes) *Proteus vulgaris* (+3 other species) *Klebsiella pneumoniae Citrobacter aerogenes* (+other species) *Edwardsiella tarda*	Faeces, water, soil	Meat, poultry, raw milk and dairy produce, pastries, cooked food, eggs, fish
Toxic infections	*Clostridium perfringens*	Human or animal faeces, soil	Cooked meat and poultry, raw food
	Vibrio parahaemolyticus	Water and seafood	Fish, crustaceans, salted meat
	Streptoccus faecalis	Human and animal faeces	Meat, cakes, milk powder
Gastroenteritis	*Bacillus cereus*	Soil, dust	Cereal products, cakes, sauces, rice, meat, bread, fish, vegetables, milk
Aflatoxicosis	*Aspergillus flavus* (and close strains)	Soil, plants	Plant products (grains), milk
Other mycotoxicoses	*Fungi*	Soil, plants	Fruit, grains, milk
Hepatitis	*Virus type A*	Infected faeces, urine, blood	Milk, water, shellfish, citrus juices
Poliomyelitis	*Poliovirus*	Faeces, throat secretions of infected animals	Milk, water, pastries

D. FOCUS ON THE FAECAL HAZARD

Open-air exposure of infected faecal matter or urine, combined with transmission factors, causes a variety of significant diseases in developing countries. Such diseases stem from the ingestion of food or water that is contaminated by stool, dirty hands or unclean or poorly protected containers.

Such contamination is common in developing countries, resulting from inadequate or non-existent sanitary infrastructure for the disposal of faecal matter and urine (appropriate latrines).

D.1. Composition of faecal matter

Faecal matter or excrement is digestive waste comprising indigestible elements of food, microorganisms and digestive secretions from the digestive tract.

The combination "digestive apparatus + faecal matter" provides all the conditions needed for microbe development and multiplication (heat, humidity and nutrients).

The excrement of individuals with certain forms of sickness (dysentery, diarrhoea) has very high concentrations of harmful microbes and parasites (amoeba, tapeworm, roundworm).

Normal bacteria in the human digestive tract can cause discomfort to consumers. This is the case with *Escherichia coli* which is a normal commensal (living in symbiosis) of the human or animal intestine. However, certain strains of *E. Coli* are pathogenic and can lead to problems of differing intensity, including serious gastroenteritis (diarrhoea, vomiting, stomach cramps) among children. Foods most commonly contaminated include butter, yoghurt, cheese, milk, fish, water, fresh vegetables and meat.

There are many vectors of contamination, for example through material (e.g. during slaughter and gutting at the abattoir), through water (latrine overflow and liquid manure) and through butcher's boards, hands and clothing.

D.2. How does faecal matter transmit disease?

Faecal matter is one of the principal sources of contamination of water, food and subsoil. Contamination can occur in or near housing, for example from defecation on the ground or near food crops, or where latrines are close to wells or badly maintained.

Sewage from overflowing latrines directly exposes food and people to contamination from microorganisms, parasitic worms and other pests, and promotes the multiplication of flies.

Contamination can also be less direct, as when untreated excreta enter water sources and then the food chain, and thus transmit germs to persons living at some distance from the initial point of contamination.

Diseases transmitted by faecal matter are mostly diarrhoeal. They are infectious or parasitic in origin. They represent a major public health concern in tropical areas where they are a primary cause of mortality and morbidity.

D.3. Control of the faecal hazard

Control of the faecal hazard needs to be preventive. Control measures should place effective sanitary barriers between excrement (the vector for microbes and disease) and people.

The only places that are truly safe for toilet functions are properly built, covered latrines that have evacuation systems that do not contaminate the environment or water. Such latrines must always be placed at least 15 metres from housing and water points (wells, river, etc.).

GOLDEN RULES

Control of the faecal hazard must be preventive and requires the proper management and evacuation of excreta, the provision of clean water and application of the basic rules of personal hygiene (body, food, faecal and urinary).

- thoroughly washing your hands with soap and water after using the latrines;
- throwing all toilet paper and other used material into the latrine pit so it is not left to litter the ground;
- urinating and defecating directly into the latrine pit so the ground is not dirtied.

1.2. PHYSICAL AND CHEMICAL CONTAMINATION OF STREET FOOD: AGENTS AND CONSEQUENCES

Besides the biological agents (microorganisms) mentioned in the previous chapter, there are other agents responsible for endangering consumer health: chemical and physical agents. Thus, street food can be contaminated during preparation, keeping and sale by chemical and physical impurities originating from raw materials, equipment, hands and surroundings. Street food is rarely covered, so gathers dust from the immediate environment, vehicle exhaust fumes and impurities deposited by flies and other insects.

A. PHYSICAL AGENTS

Injuries can be caused by foreign bodies in food:

- shards of glass from broken bottles or overhead light bulbs,
- splinters of wood from surroundings, boxes, structures, etc.,
- stones,
- metal chips from surroundings, wire, etc.,
- small pieces of bone,
- personal belongings (jewellery worn by handlers), etc.

These agents exist because of poor practices from procurement to consumption. They can be eliminated relatively easily by good handler/vendor practices. They can cause a litany of consumer mishaps: broken tooth, choking, cuts, infection, etc.

B. CHEMICAL AGENTS

Chemical agents in street food can originate from a number of sources. Some of the utensils used release metal particles into the food, such as copper, lead and iron. Lead contamination of food can also come from the water used during preparation when the pipes are made of lead, or from pollution in the air as street food is often exposed to dust that can contain lead from vehicle exhaust fumes (**Illustration 1.2**). The surrounding environment can also cause other forms of contamination from heavy or assimilated metals, including cadmium, mercury and arsenic.

Several chemical substances are used in agriculture (fertilizers, pesticides, veterinary drugs). They are strictly regulated. Some substances are permitted while others are forbidden because considered dangerous. The regulations also specify doses and methods of application. If used sensibly and in compliance with regulations, these substances should not present a hazard to consumers.

However, unauthorized substances might sometimes be used, or authorized substances

inappropriately used (excessive doses, non-compliance with technical specifications), which can then pose a hazard to consumers. Plant raw materials on the market, such as fruits and vegetables, can sometimes contain pesticide residues, which can also feature in the drinking water. Animal raw materials, such as chicken, turkey offal and meat, are sometimes contaminated with chemical residues, notably veterinary products used during production. Finally, food additives like colouring, flavouring and preservation agents are not always rigorously used in street food, so it is important to check that supply sources are reliable and that additives are authorized and properly dosed.

REMEMBER

The consumption of products contaminated by microbes causes a variety of conditions: indigestion, vomiting, diarrhoea, dysentery, cholera, typhoid fever, paratyphoid fever, hepatitis, tuberculosis, parasitosis, etc.

Many chemical substances (heavy metals, unauthorized chemical additives, pesticide and veterinary drug residues) introduced intentionally or not into street food have proved to be toxic. Ingesting these substances through food causes a variety of conditions and complaints: allergies, anaemia, albuminuria, hepatitis, tumours, etc.

Exercise 1

1. What are the agents responsible for food contamination?
2. What are the possible origins of microbes that contaminate street food?
3. What are the consequences for the consumer of street food contaminated with microbes?

DESCRIPTION

A woman selling food in an area polluted by vehicle exhaust fumes (**practice to be discouraged**).

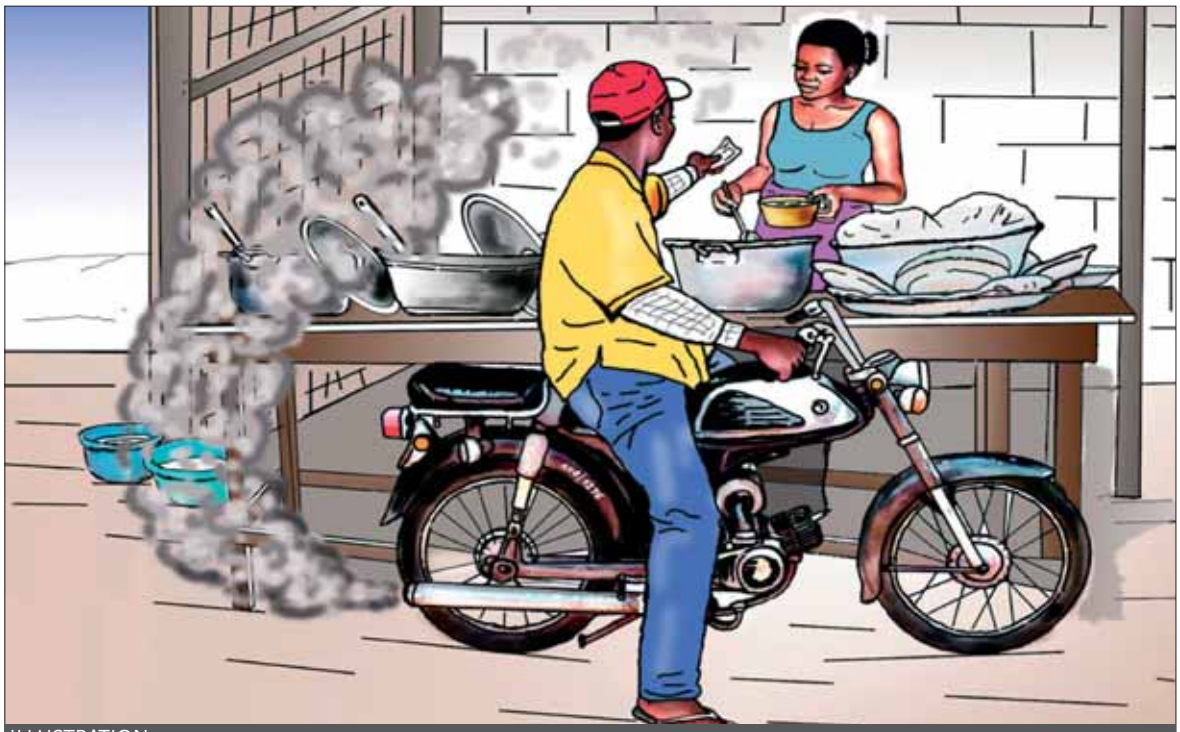


ILLUSTRATION 1.2

MESSAGE

Let's avoid exposing our food to vehicle exhaust fumes and reduce the risk of chemical contamination and harm to consumers.

MODULE 2

HYGIENE AND QUALITY OF RAW MATERIALS AND INGREDIENTS

PLAN

TRAINING OBJECTIVE

The objective of this module is to provide street food practitioners with the basic knowledge and principles needed to guide them in the choice, purchase and management of good quality raw materials and ingredients.

On completion of this module, they should:

- know the basic principles to guide them in the selection and purchase of raw materials and ingredients;
- be able to assess the hygiene of the purchase points;
- know the fundamental principles to be applied during the transport, storage and preservation of raw materials and ingredients.

KEY WORDS

Dirt – Spoilage – Microbe – Pollutant – Contamination – Germ – Perishable good
Sanitary quality – Contaminant – Official stamp – Pesticide residue

2.1. PROCUREMENT OF RAW MATERIALS AND INGREDIENTS

A. PROCUREMENT CHANNELS

Street food operators generally procure their agricultural raw materials from two main channels. Some operators purchase their raw materials on the main urban markets, from retailers or from wholesalers who themselves procure their supplies from the rural sector. Others obtain their supplies directly from producers or from rural markets close to the urban areas. Some farm products, especially vegetables, are purchased from urban and periurban market gardeners.

Fresh animal products such as fish and eggs are purchased from market traders and urban producers (marine and lagoon fishers, poultry farmers).

The necessary finished or semi-finished products (rice, pasta, manufactured beverages, etc.) are purchased from traders or industrial production plants.

Purchases are usually paid in cash. However, in the case of some products (maize, millet, sorghum, wheat flour, bread, oil, meat, etc.), operators have regular suppliers with whom they sometimes have special social relationships and who sometimes agree to advance the merchandise on credit.

The procurement of raw materials and ingredients is also done through family links or clan networks. This enables street food operators to get good prices, regular supplies and credit.
The women vendors sometimes band together in informal associations to buy in bulk and negotiate prices to counteract seasonal price fluctuations of certain raw materials.

First choosing a supplier and staying with that supplier are important aspects of food quality. When a good supplier has been found, it is important to try to convert the business relationship from sporadic purchase to trusted supply in order to involve the supplier in determining the necessary quality of product. Although the primary concern for most street food operators is usually price, the concept of quality has gradually entered negotiations of operators who have built successful businesses. The notion of "quality premium" can sometimes be introduced, a strategy generally used by agrifood corporations, but also relevant to the street food sector.

GOLDEN RULES

In all cases and whatever the form of procurement of raw materials and ingredients, it is important to carefully choose raw materials and ingredients from recognized traders who offer guarantees of sanitary quality.

B. HYGIENE OF PURCHASE POINTS

There are many different purchase points for raw materials and ingredients: fields, farms, family market gardens, rural markets, urban markets, butcher shops, fishery landing sites, shops, stores, etc. The state and cleanliness of the purchase point are often indicators (though not cast-iron guarantees) of a trader's professional approach. Also, unsanitary premises are likely to contaminate raw material of good quality, before purchase by the street food operator.

Street food operators need to consider the hygiene of purchase points when choosing suppliers, who should operate in clean surroundings:

- away from public refuse dumps, rubbish heaps, public toilets, animal pens, dustbins, etc. (**Illustration 2.1**).
- far from uneven ground that can catch stagnant water in the rainy season (**Illustrations 2.2 and 2.3**).

The purchase point and surroundings must be kept clean. They should be weeded if necessary and cleaned daily by sweeping, dusting, and collecting and destroying rubbish.

They should also be thoroughly cleaned at regular intervals, washing with soapy water and disinfecting the wall tiles and floor and eliminating insects and rodents (**Annex 2**).

GOLDEN RULES

The source of raw materials will determine the sanitary quality of the food. Therefore, before selecting and purchasing raw materials, street food operators must:

- know where the produce comes from by visiting the market stalls, the stores and the storage areas;
- if possible, find out about the conditions of transport and delivery of the produce;
- make sure that the produce has been carefully protected against all pollutants, the sun and bad weather.

DESCRIPTION

Purchasing meat from a clean stall: a woman buying meat from a traditional butcher. We can see:

the cleanliness of the surroundings:

- there is no rubbish or household waste;
- the merchandise is displayed with professional competence;
- the butcher is clean in appearance;
- he is holding a fly-whisk.

evidence of veterinary inspection:

- a visible stamp on the carcass (**practice to be encouraged**).

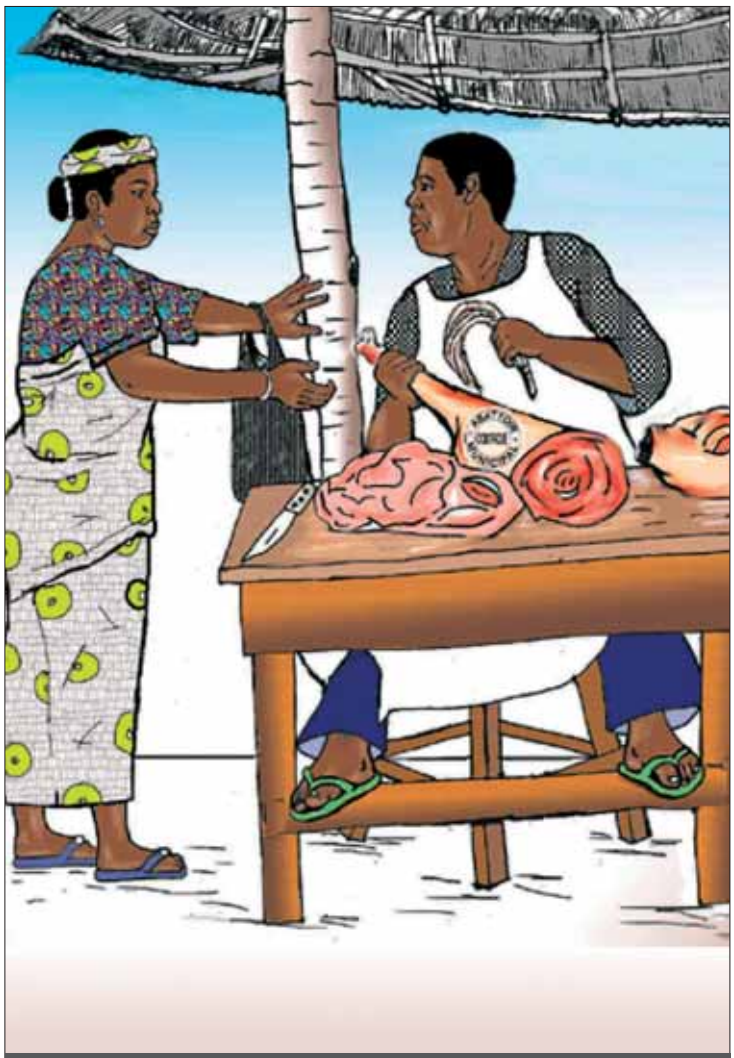


ILLUSTRATION 2.1

MESSAGE

I buy my meat from a clean butcher's stall with evidence of veterinary inspection.

DESCRIPTION

A woman buying her tomato, chilli and onion supplies from a vendor of fresh produce displayed in raised baskets in clean surroundings (**practice to be encouraged**).

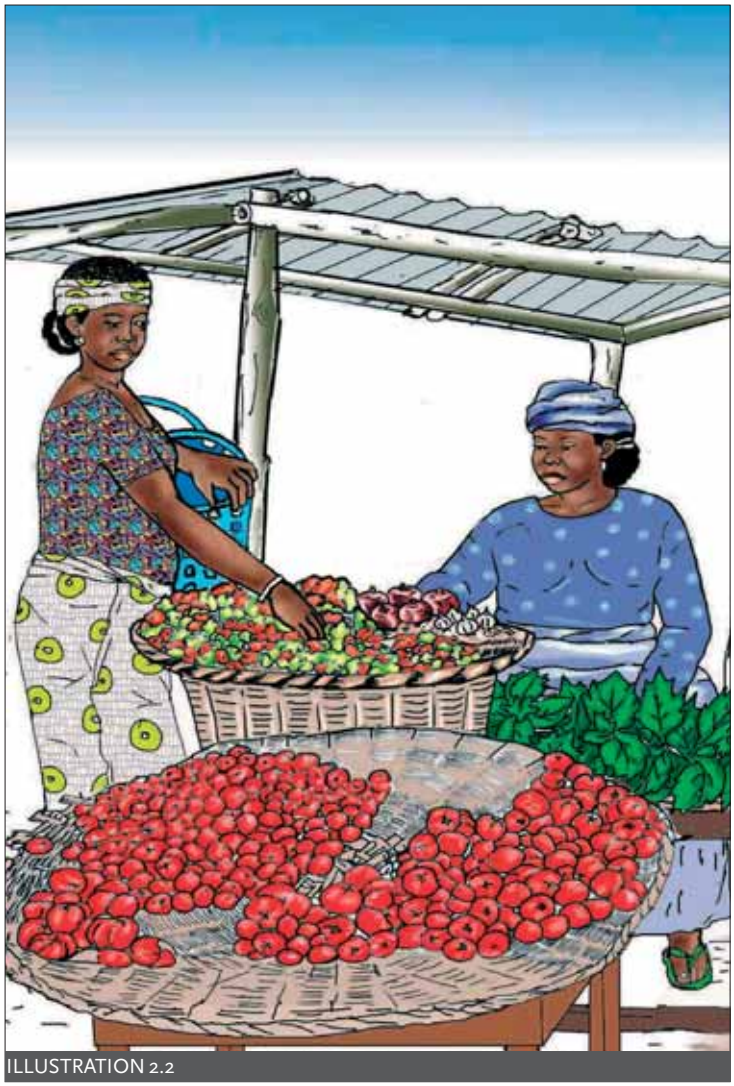


ILLUSTRATION 2.2

MESSAGE

I buy my vegetables and spices from a vendor who can guarantee their freshness and sanitary quality

DESCRIPTION

A woman buying vegetables and spices displayed on the ground in unsanitary surroundings (**practice to be discouraged**).

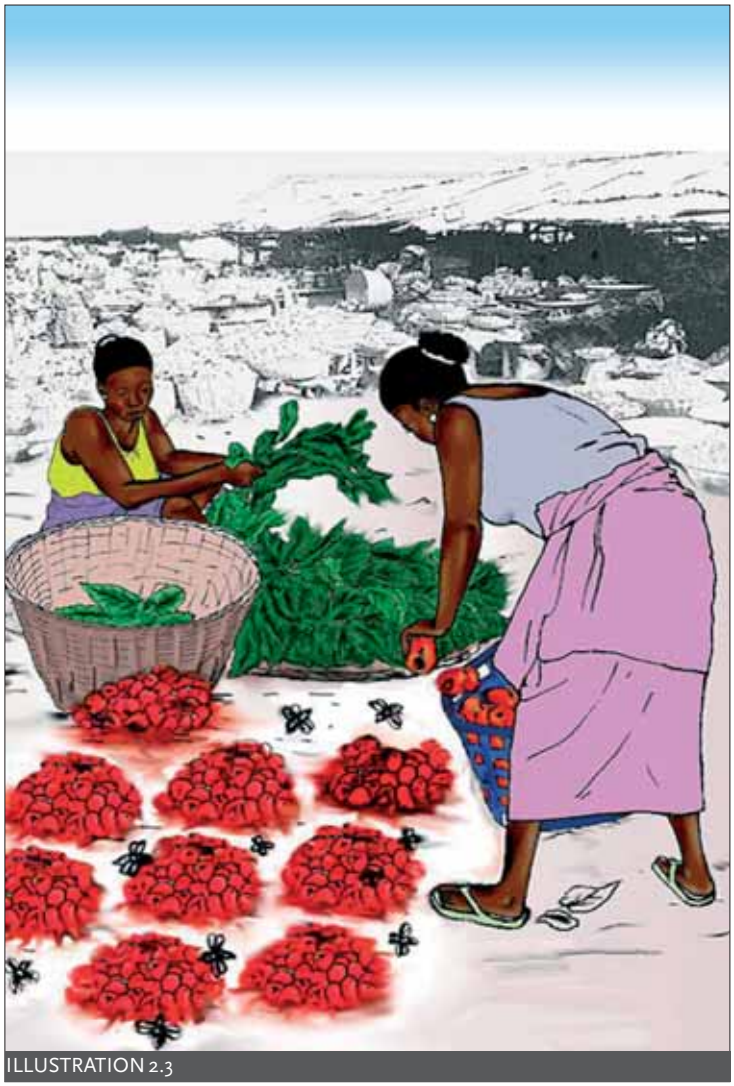


ILLUSTRATION 2.3

MESSAGE

Avoid buying raw materials displayed in unsanitary surroundings.

C. CRITERIA FOR THE SELECTION OF RAW MATERIALS AND INGREDIENTS

When selecting raw materials and ingredients, focus on their freshness, appearance, variety, quality and price, but also on the hygiene of the vendor and his surroundings.

The basic personal hygiene of the vendor is essential. He should wash his hands after handling dirty material or toxic products or after going to the toilet. He should keep his nails short as these can be breeding grounds for microbes.

The cleanliness of the vendor's clothing is an important measure of hygiene and a good indicator of professional rigour. Garments get dirty from vending activity and should be frequently washed. Better, the vendor/handler is strongly advised to wear an apron.

The street food operator should immediately cease all food preparation and vending activity in the event of diarrhoea, vomiting or skin wounds.

Food products sold on markets or from other outlets are not always of good quality. Some products may be deteriorated or spoiled.

GOLDEN RULES

It is essential to observe the following rules when purchasing food:

- visually check food to be used for prepared meals;
- do not hesitate to refuse any food that is tainted;
- always check the quality of produce (appearance, smell, foreign bodies, insects, etc.) and the display stand;
- avoid buying raw materials from vendors who do not observe the rules of personal hygiene, clean clothing and proper conduct.

Let's look at specific products:

▶ Fish

Fishery products require strict precautions that extend from catch to consumption, as they are very prone to spoilage (**Illustrations 2.4 and 2.5**).

Good quality fish should have:

- an appearance of freshness and firm flesh;
- fins that are intact and wet;
- moist and shiny pink or red gills;
- clear bright eyes that fill the whole orbit cavity;
- a tightly closed anus that is not greenish.

▶ Meat

The following rules and criteria apply when choosing good quality meat (**Illustration 2.6**):

- good quality meat should be bright red in colour; there should be no greenish, blackish or dark red colouring;
- good meat should not smell bad;
- swarms of flies over the display counter indicates loss of flavour and exposes the meat to

serious risk of microbial contamination;

- meat handled with bare hands and left in the open is exposed to serious contamination and should be avoided;
- meat recognized as fit for human consumption bears a veterinary stamp certifying the good health of the animal of origin.

▶ Fruit, vegetables and condiments

At the market, fruit, vegetables and certain condiments (chilli, tomato, onion, garlic, etc.) should always be bought fresh. One selection criterion for fresh vegetables is that they should be firm in appearance. Their skin should not be broken, nor damaged by pests. They should have no surface rot or dirt. Vegetables grown under poor conditions represent a real hazard for consumer health. Diseases are transmitted through the inappropriate application of manure and an excessive load of microorganisms or by irrigating vegetables with contaminated water. Misused pesticides leave residues in vegetables.

▶ Grains and seeds

Selected grains and seeds should be:

- whole;
- healthy and free of indications of rotting or spoilage such as to render them unfit for consumption;
- clean and practically free of visible foreign matter (stones, pieces of metal, rodent excreta, etc.);
- free of foreign smells and/or flavours;
- free of attack from pests, especially weevils and other parasites that can present a hazard to consumer health.

In theory, we could recommend that grains and seeds be free of microorganisms or heavy metals in quantities presenting a hazard to health and that they comply with the pesticide maximum residue limits of the Codex Alimentarius Commission, but it is very hard for the vendor/handler to check this in practice. Here again, supplier integrity and awareness are the only criteria the purchaser can check.

▶ Oils

Selection should be based on:

- colour: palm oil is red;
- shelf life for refined oils. It is essential to check the expiry date on the packaging.

▶ Flour

When choosing flour is it is important to:

- avoid buying flour that is mouldy or that has been in contact with moisture;
- check for the presence of visible foreign matter (insects, stones, pieces of metal, rodent excreta, etc.);
- check that the products are free of foreign odour and/or flavour.

▶ Eggs

- at the market, avoid eggs exposed to sunlight;
- a good egg held up against the sun has no black mark.

▶ Canned food

Avoid buying:

- a can that is swollen as its contents are contaminated by microorganisms, some of which can cause a serious fatal sickness called "botulism";
- a can that is dented, rusty or leaking;
- a can without expiry date or passed its expiry date. Purchasers are strongly advised to check the expiry date on cans.

D. MANAGEMENT OF RAW MATERIALS

When taking delivery of goods from a supplier or market, it is important to check that the products meet quality requirements. One way of ensuring quality is to have a regular network of suppliers who are fully aware of the quality criteria for raw materials and ingredients and are thus able to ensure their sanitary quality.

D.1. Labelling of raw materials and ingredients: mandatory specifications to be checked.

Processed foods should bear the following specifications:

- name of product;
- list of ingredients;
- quantity;
- name and address of producer, distributor or vendor;
- the shelf life of the product, which can be a use-by date or a best-before date, and storage instructions;
- the lot identification number.

▶ Use-by-date

This is used for perishable food and is written as "**use by day/month/year**".

Example: use by 28/04/2004 means that the product is fit for consumption until and including 28 April 2004.

▶ Best-before-date

This is used for stable or stabilized food products (dried vegetables, cans...) and reads "best before day/month/year". After that date, the product is still safe for consumption as it maintains biological stability but its organoleptic qualities begin to deteriorate.

D.2. Checking on delivery

Contamination is possible when packaging is damaged, when the use-by date is passed and, for chilled produce, when the cold chain has not been maintained. For example, traders often turn off their refrigerators at night to save electricity. They then turn them back on in the morning before the first customer arrives. This practice should be contested as food requiring chilling but left unchilled will soon spoil.

Preventive and surveillance measures are required: check the wrapping and packaging, check the use-by dates, check the temperature of goods on delivery and inspect merchandise visually.

GOLDEN RULES

QUALITY CRITERIA WHEN CHOOSING RAW MATERIALS AND INGREDIENTS

The quality of raw materials and ingredients determines the quality of end product. Poor quality can cause various forms of food contamination, indeed food poisoning.

Street food vendors/handlers should therefore purchase their basic supplies from sanitary surroundings and vendors who observe the rules of food hygiene.

Street food vendors/handlers should have a regular network of suppliers who are aware of the quality criteria for raw materials and ingredients and thus able to ensure their sanitary quality.

In particular, they should procure their meat supplies from approved butchers who can guarantee the sanitary quality of their merchandise.

Street food vendors/handlers should check the use-by dates and best-before dates and make sure they check products on delivery.

LEARN MORE

MEAT

Animal slaughter triggers a sharp reduction in energy reserve (Adenosine Triphosphate – ATP) and halts blood circulation which deprives muscle tissue of oxygen and causes other biochemical changes. The muscle proteins (actin, myosin) bind irreversibly. The result is cadaver rigidity or rigor mortis. In beef muscle, this process takes about eight hours at ambient temperature.

Meat should not be frozen before it has reached complete rigidity, and it should never be cooked in a state of rigor mortis.

The meat softens over time: this is meat "maturation". Under these conditions, the meat texture improves after cooking.

But fresh meat is very perishable and any delay in transport, distribution and maturation requires refrigeration in the short term and preservation treatment in the long term. When purchasing meat, it is essential to check there is no exudate (meat fluid); its presence indicates deterioration and possible loss of flavour. Every animal is inspected by a veterinary officer before slaughter. There are two inspections:

- Inspection of the standing animal to check its state of health. This serves to identify and eliminate animals that are diseased, injured or unfit for consumption and that can transmit disease to humans. Such animals are withdrawn from human consumption.
- Inspection of the carcass which provides confirmation or otherwise of the sanitary quality of the meat. Meat recognized as fit for human consumption is marked with a stamp of approval (sign or seal in edible ink), certifying its sanitary quality.

LEARN MORE

FISH

Fish flesh is clean and aseptic. But as soon as fish dies, its tissues undergo very rapid deterioration due to: a proliferation of bacteria, a pH close to neutral and an abundance of substrates that provide a favourable environment for bacterial growth. Microbe proliferation produces malodorous and sometimes toxic volatile compounds, such as trimethylamine, methylmercaptan, dimethyl sulphide, hydrogen sulphide and ammonia. Fish can be contaminated at all stages of handling (fishing, unloading, transport, sale, etc.). The germs responsible are essentially concentrated at two levels: in the skin mucus (up to 100 000 germs/square centimetre of skin) and in the intestines (up to 10 million germs/square millimetre of intestine); and the action of endogenous enzymes which provoke the softening of muscle (proteases), the hydrolysis and oxidation of lipids (lipase, oxidoreductase) and discolouration of the flesh.

These transformations are slowed but not halted by reducing temperature. Pseudomonas for example only stop multiplying at about -5°C.

In addition, the action of certain bacteria on the flesh of fish (particularly tuna, sardine and mackerel) causes the formation of histamine. The ingestion of histamine produces food poisoning and allergic reactions which no thermal treatment of the fish (cooking, freezing, etc.) can destroy, once histamine has been produced. It cannot be detected by deterioration of flavour so the consumer is not alerted to the possibility of food poisoning.

2.2. REQUISITE CONDITIONS FOR THE TRANSPORT, STORAGE AND PRESERVATION OF RAW MATERIALS AND INGREDIENTS

A. TRANSPORT OF RAW MATERIALS AND INGREDIENTS

Markets are generally distant from street food stalls so purchased raw materials and ingredients need to be transported.

Transport should be hygienic to prevent products from becoming dirty or damaged and to safeguard their quality, especially their sanitary quality. Efforts should be made during the transport of raw materials and ingredients to reduce, if not eliminate, risks of deterioration and contamination from surrounding microorganisms and pollutants. There are two possibilities:

- Carriage in containers directly by the vendor/handler (basin, bowl, bucket, basket, etc.). In this case:
  - the containers should be washable, designed for the transport of food products and made of materials (such as stainless steel) that do not release dangerous and toxic chemical or physical substances into the products;
  - products likely to pick up dirt from contact with the soil (vegetables, fruits, etc.) should be separated from products of animal origin (meat, eggs, fish, etc.) (Illustrations 2.7 and 2.8);
  - low temperatures should be maintained for perishable goods, if possible using insulated containers (Illustration 2.9).

  Care should be taken to ensure that purchased raw materials and ingredients remain intact during their transport by covering them with material or plastic film and protecting them from all forms of contamination and pollution. Chilled or frozen products should not be purchased at the start of a market to avoid leaving them in baskets or trolleys for long periods in the sun and at ambient temperature, which would hasten their thawing, contamination and spoilage. The transport of perishable goods should be as quick as possible, avoiding stoppages and by the shortest route.

- Transport by vehicle (car, motorcycle, cart, etc.). In this case, food products should be wrapped, then placed in containers to protect them from dirt and to significantly reduce the formation of water condensation.

  Produce transported in car trunks should be arranged in such a way that there is sufficient circulation of air. Food products should not be in contact with the vehicle floor unless completely wrapped. Products not in resistant wrapping should not be placed on the ground during loading and unloading operations.

GOLDEN RULES

Good conditions of transport help maintain food quality and prevent the growth of microorganisms. So it is important when transporting food:

- to use a clean basket, basin, bucket, bowl or trolley;
- not to mix products of animal origin or these with products of plant origin in order to avoid cross-contamination. Meat and fish or meat/fish and vegetables should not be placed together without waterproof separation.
- during transport, temperature regulations should be observed and the cold chain maintained.

B. STORAGE AND PRESERVATION OF RAW MATERIALS AND INGREDIENTS

On return from the market, raw materials and ingredients should be properly stored. Poor storage conditions facilitate the proliferation of germs, pollution and food deterioration. It is recommended that meat be frozen to preserve its required characteristics. Freezing meat is becoming common practice within households. Freezers marked with four stars function at two temperatures: a freezing temperature of between -25 and -30°C and a single temperature of -18°C to preserve previously frozen and deep frozen products. Fresh poultry meat should be kept chilled at between 00 and -40C.

However, street food operators do not usually have refrigerators or freezers, which limits their food storage and handling capacity. Closed structures (cabinets, larders, drawers, jars, etc.) used to store food not under cold chain conditions should be large enough for orderly stowage. There should be separate sections for different food products. None should be placed on the ground and cluttering should be avoided. Bulk products, especially grains, should be kept in waterproof containers raised on clean tables or shelves, rather than in sacks, because of mice and other pests. Fumigation with appropriate gases or rapid impact insecticides should be applied against insects, but without any food present, and followed by airing and washing. If possible, fumigation should be left to experts. Traps rather than poisons should be used to eliminate rodents, as poisons can also be dangerous to humans. Vegetables and fruits are not inert bodies, even after harvesting. They should be handled with care and stored under good conditions. Each fruit and vegetable has an optimal storage temperature above or below which it is prone to some form of damage.

That temperature generally varies between -2°C and +10°C. Letters or fruit and vegetable symbols are often used to identify their refrigerator compartments. However, their storage temperature should be checked daily and their holding period kept as short as possible. Finally, food storage should follow the "first in first out" principle. The order of purchase and storage should be recorded for stock rotation, otherwise overlooked produce could start to rot, causing wastage, or eventually be used when no longer fit for consumption, exposing customers to risk. It is in the operator's interest to devise an appropriate system and to avoid relegating old products to the back of the shelf when buying new ones.

GOLDEN RULES

It is essential to observe the following good conditions of hygiene when storing food products to protect them from pollutants, microbes and other harmful agents:

- keep products well wrapped;
- keep them in clean containers raised on clean tables or shelves;
- protect them with covers or plastic sheeting;
- keep storage facilities and shelves clean;
- systematically destroy all spoiled products;
- control insects and rodents;
- check the personal hygiene of staff entering storage facilities.

The storage facilities should be so designed that:

- they can be easily and thoroughly cleaned;
- air can easily circulate;
- they are protected against pests;
- no domestic animal is allowed entry.

Exercise 2

1. What are the key criteria or principles when selecting raw materials and ingredients? Give specific examples.
2. How can raw materials be stored for keeping on return from the market? Explain with specific examples.

DESCRIPTION

A woman buying recently landed fish. She buys her fishery products from suppliers who can guarantee their freshness and transports her purchases in an ice-cooler (**practice to be encouraged**).

ILLUSTRATION 2.4

MESSAGE

I buy my fish and fishery products from suppliers who can guarantee their freshness.

DESCRIPTION

A woman selling fish covered with flies; the street food operator gives her a miss and goes to another vendor whose fish, practices and conditions seem more hygienic (**practice to be encouraged**).

ILLUSTRATION 2.5

MESSAGE

Avoid buying fish and fishery products that are not covered and poorly kept.

DESCRIPTION

Purchasing meat from a hygienic stall (urban setting) like this modern butcher's (**practice to be encouraged**).

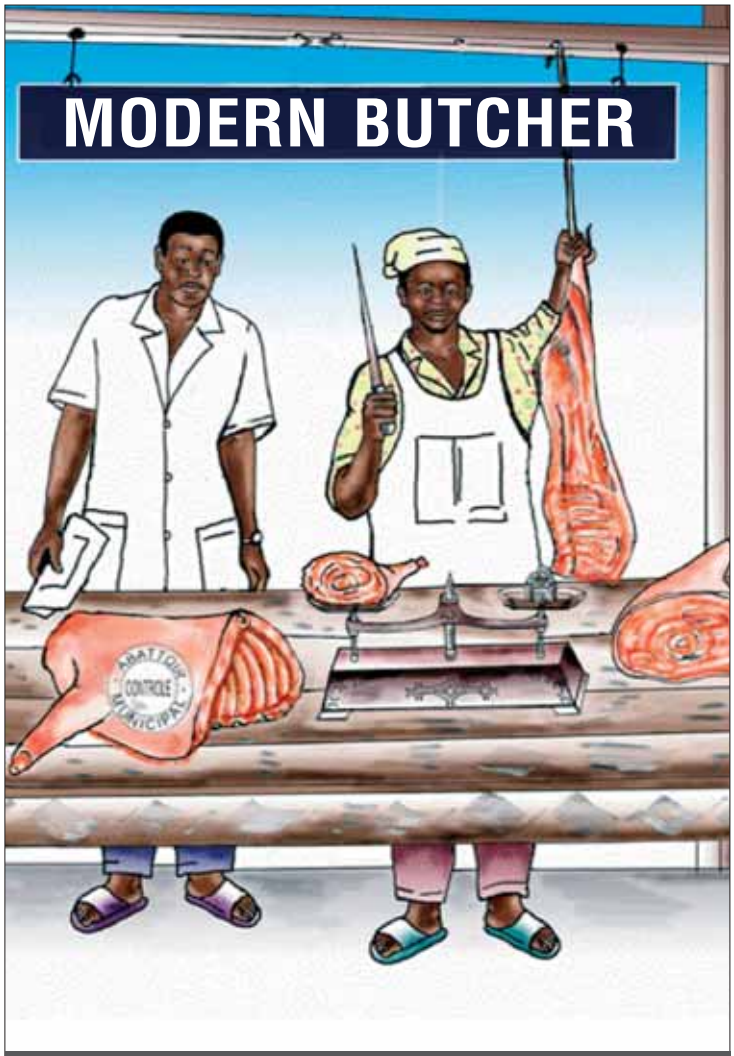


ILLUSTRATION 2.6

MESSAGE

In town I buy meat from a modern butcher's.

DESCRIPTION

On her return from market, a woman carries all her supplies
(animal and vegetable products) in the same basket (**practice to be discouraged**)

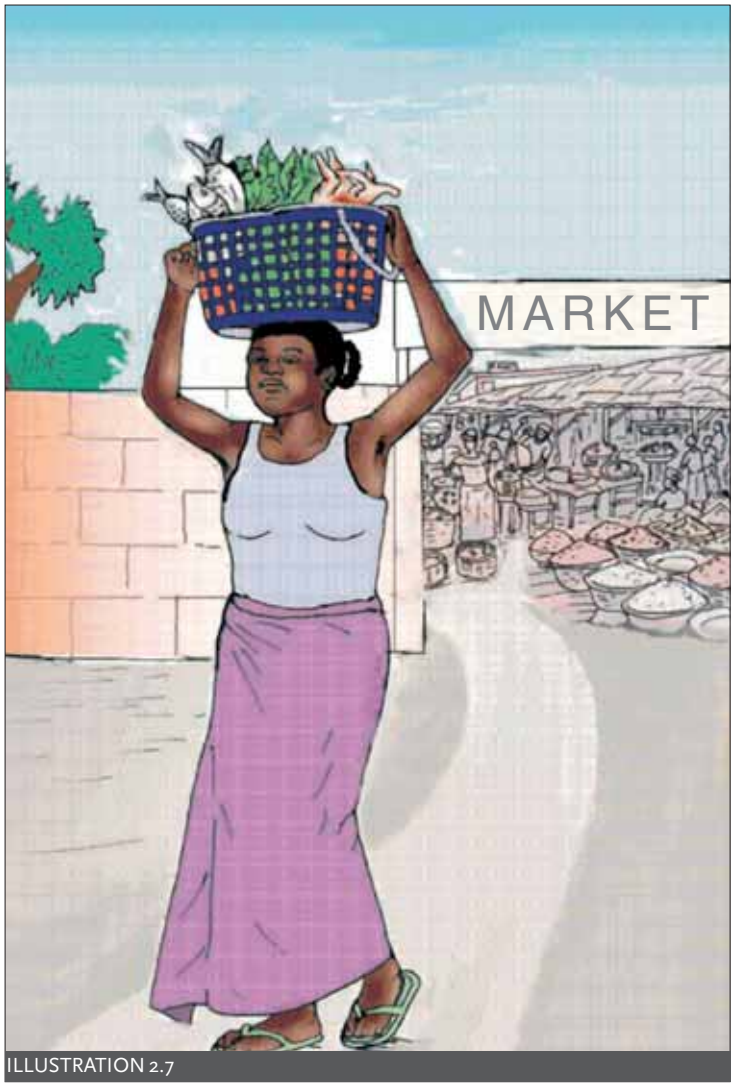


ILLUSTRATION 2.7

MESSAGE

Do not put all your purchases of raw materials and ingredients in the same basket.

DESCRIPTION

On her return from market, a woman carries her purchases in different baskets, some of them covered (**practice to be encouraged**).

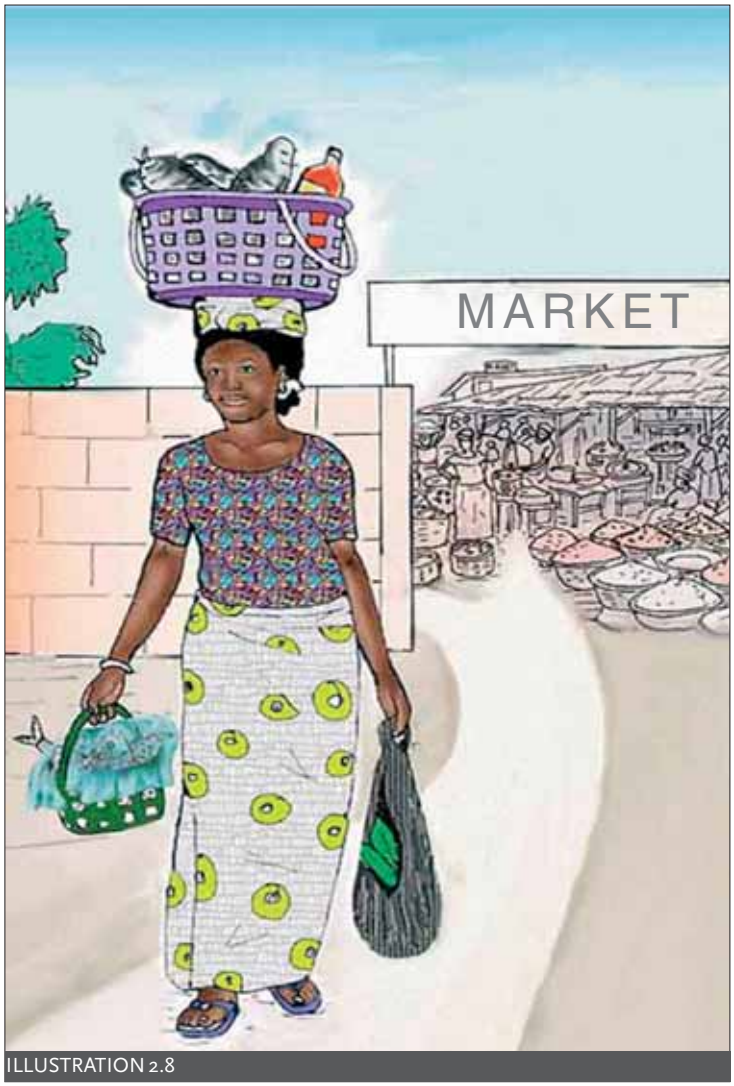


ILLUSTRATION 2.8

MESSAGE

I cover my raw materials and ingredients against dust and dirt and avoid mixing them.

DESCRIPTION

A woman transferring her purchases from ice-cooler to freezer to avoid breaking the cold chain between purchase, storage and preparation of fish (**practice to be encouraged**).

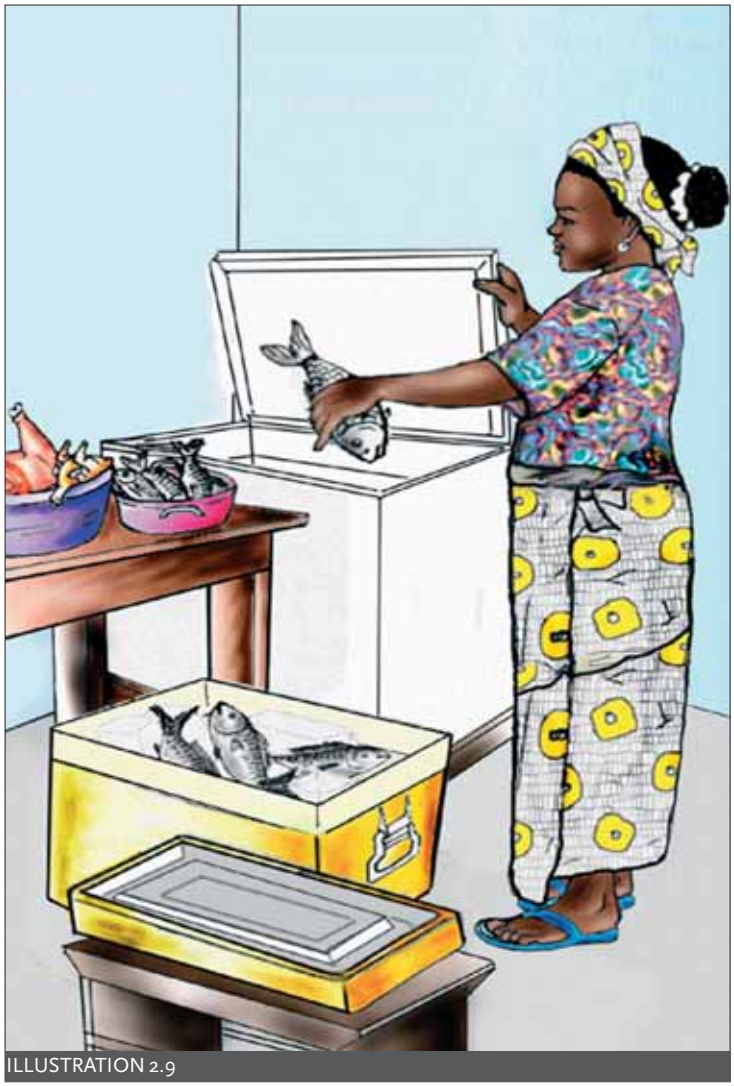


ILLUSTRATION 2.9

MESSAGE

Avoid breaking the cold chain between purchase, storage and preparation of meat and fish.