Chapter

Food Safety

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Abstract

Food safety is a worldwide topic that affects a wide range of aspects of daily living. For consumers' health, identifying sources of pollutants in food production and processing, as well as establishing proper production practices, is critical. The factors that produce food contamination may threaten its safety for consumption, making foods potentially hazardous to human health. As a result, a range of resources must be used to prevent food contamination at every level of the food chain, from harvest to consumption. Despite the fact that the factors endangering food safety appear to be straightforward to control in theory, studies and current practices reveal that there is still a long way to go in practice. The purpose of this chapter is to identify the factors that influence food safety and provide effective intervention approaches for food-borne illness and additionally utilized for food industry regulation, consumer health protection, and consumer safety. Despite the importance of educating customers about food safety, more consumers are likely to desire safer food in the first place. Setting food safety regulations and standards will include increased input from the whole food industry.

Keywords: food safety, health, source of contaminants, contamination hazards, foodborne disease (FBD)

1. Introduction

Food safety is universally acknowledged to be a public health issue. It demands a holistic strategy from manufacturing or production to consumption. It involves a wide range of activities, from on-farm production to processing, distribution, storage, selection, preparation, and consumption. As a result, it is a discipline that defines the food value chain in such a way that food poisoning is avoided. Up to 30 percent of the world's population is thought to contract a food-borne illness every year [1]. Governments acknowledge their obligation to create a strong national food control system in response to this. Ensure food safety from farm to table, this typically entails combining a mandated regulatory approach with preventive and educational measures [2].

It is a major problem that affects everyone on the earth. Many countries around the world are becoming increasingly reliant on their food supply's availability and safety. As a result, food safety is becoming more important to people around the world; food production should be done properly in order to optimize public health and environmental benefits. Food safety is concerned with avoiding dangerous microbiological and chemical agents from entering, growing, or surviving in the food supply chain [3]. As a result, food safety and quality are key issues that need to be addressed more globally, particularly in terms of nutritional quality and human health. The purpose of

this chapter focuses to identify the factors that influence food safety, current challenges, and effective food-borne illness intervention approaches and employed to regulate the food industry, safeguard consumer health, and ensure consumer safety.

1.1 Why food safety?

Public attention to recent foodborne-illness outbreaks raises an obvious question. Why are not contaminants before they sicken the consumer? The problem is that no amount of testing can ensure that every food item is free from incidental and or intentional contaminants [4]. Each year, thousands of people die as a result of foodborne diseases, which afflict millions of people worldwide. Although many of these diseases can be avoided, this is an avoidable problem that hurts both people and the economy. In addition to lowering the risk of foodborne illness, continued food safety improvements can have economic and societal advantages.

- Reduced financial loss and medical costs for the afflicted person improvements product
- In addition to ensuring food supply from farm to table to increase consumer confidence, as a result, better public health, the load on the country's healthcare system is reduced

1.2 Components of food safety and risk assessment

To prevent food from becoming tainted and causing illness, there exist laws governing food safety. There are several ways to do this, some of which are given below:

- Equipment and utensil surfaces should be thoroughly cleaned and sanitized.
- Maintaining good personal hygiene, especially with regard to handwashing.
- Keeping food properly chilled, heated, and stored according to equipment, environment, and temperature.
- Implementing effective pest management is necessary.
- Understanding food allergies, food intolerance, and food poisoning.

A contemporary risk-based food safety system uses a farm-to-fork preventive strategy and focuses on proactive data gathering and analysis to better identify possible hazards and risk factors, plan and evaluate treatments, and prioritize prevention efforts. Such a method concentrates scarce resources on the parts of the food chain most likely to improve public health [5] (**Table 1**).

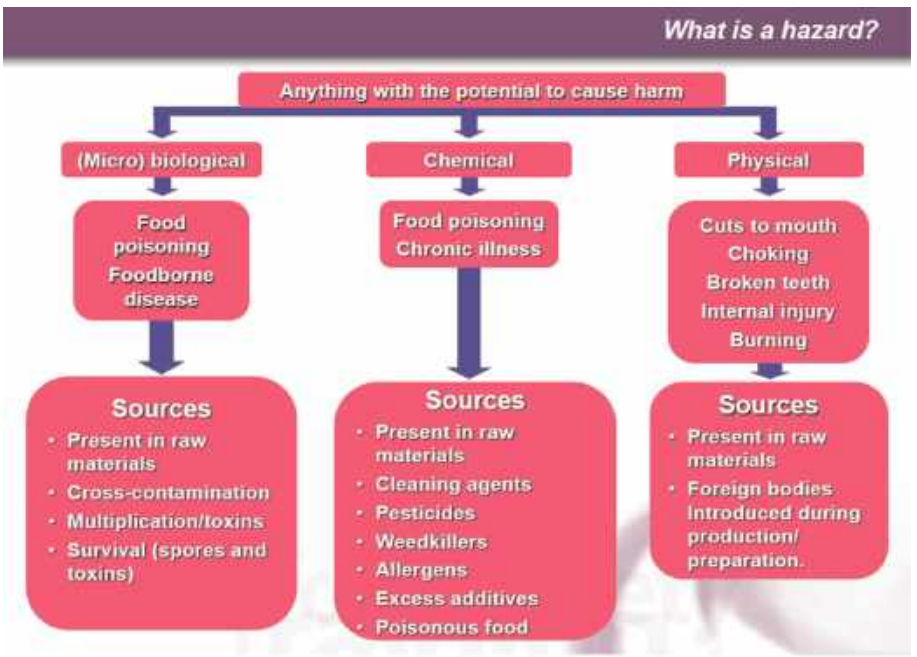
1.3 Food safety and the types of food contamination hazards

Food contamination is when something that should not be there contaminates food and renders it dangerous to consume. Food contamination can result from a variety of food safety risks, but the majority fall into one of three categories: Biological, physical,

Risk Analysis	**Risk Assessment** -Hazard identification -Hazard characterization -Exposure assessment -Risk characterization -Scientific /technical recommendation/
	Risk management -Risk profile -Risk evaluation -General and specific policies -Option assessment -Monitoring and review
	Risk communication -Information acquistion -Information distribution and interractive exchange of information and opinion concering risk

Table 1.
Food safety risk analysis.

or chemical contamination. A single risk can frequently introduce multiple types of food contamination [6]. Types of food contamination hazards and the causes of foodborne disease: Biological, chemical, and physical hazards. Foodborne diseases can be caused by many different agents or hazards. In risk analysis terminology, these hazards are categorized as:



1.3.1 Biological contamination hazards

When living organisms or the compounds they create infect food, it is said to have undergone biological contamination. The biological material created by people, rodents, insects, and bacteria is included in this. Food spoilage and food waste are frequently brought on by biological contamination, which is the main source of food-borne illness and food poisoning. Food-borne illnesses can be brought on by bacteria, viruses, parasites, protozoa, fungi, and prions, among other microbes. Bacteria and other pathogens thrive in foods that are moist, high in protein or starch, and neutral in acidity.

Follow food safety best practices to restrict bacterial development through adequate food handling skills, rigorous cleaning and sanitizing processes, and time and temperature control of food in order to slow down the growth of germs and prevent food safety issues. The growing desire of consumers in developed countries to consume fresh fruits and vegetables coupled with the expanding global nature of produce distribution has led to an increase in the reported pathogens, outbreaks, and incidences of contamination [7] (**Table 2**).

1.3.2 Physical contamination hazards

When a physical object penetrates food during the production or preparation process, physical contamination occurs. In addition to posing a choking risk, physical items in meals frequently bring biological pollutants. Finding an object in their food can be quite upsetting for a consumer, even if they would not be injured by it (who knows that harmful microorganisms on the object could make them ill). In the food industry, common examples of physical pollutants include hair, fingernails, bandages,

Source of pre-harvest	Postharvest
Feces	Feces
Dust/soil	Human handling (workers and consumers)
Irrigation water	Harvesting equipment
Water used to apply fungicides	Transport containers (field to packing shed)
Insecticides or inadequately composted manure	Wild and domestic animals (including fowl and reptiles)
Air	Insects
Insects	Air
Human handling	Wash and rinse water Sorting, packing, cutting, and further processing equipment
Wild and domestic animals (including fowl and reptiles)	Improper display temperature
	Improper packaging (including new packaging technologies)
	Cross-contamination (order of foods in storage, preparation, and display areas)

Table 2.
Sources of pathogenic microorganisms to produce.

jewelry, broken glass, staples, plastic wrap/packaging, dirt from unwashed fruits and vegetables, pests/pest droppings, and rodent hair.

1.3.3 Chemical contamination hazards

Food that has been contaminated with unsafe assortments or produced with them might cause chemical food poisoning. Chemical pollutants can be classified as either natural or man-made. Common chemical contaminants include cleaning products (e.g., detergent and sanitizer), pesticides/herbicides, toxic chemicals in metals and plastic, preservatives, and naturally occurring toxins. Toxic substances produced by living things, some of which are staples of the human diet, are known as naturally occurring toxins (e.g., shellfish, potatoes and fish). Although these toxins are not harmful to the organisms themselves, eating them could be harmful to humans.

To minimize the risk of chemical contamination occurring in food industry label and store chemicals separately from food, use the appropriate chemical for the job you are doing, follow the chemical manufacturer's instructions with regards to dilution, contact time and water temperature, use chemical pest control products with extreme care, or outsource pest eradication to a professional pest control service.

Use the right chemical for the job at hand; adhere to the manufacturer's dilution, contact time, and water temperature instructions; use chemical pest control products with extreme caution, or outsource pest eradication to a professional pest control service in order to reduce the risk of chemical contamination occurring in the food industry.

1.3.4 Cross-contamination risks

Cross-contamination is the unintentional transfer of contaminants from one surface or material to another, and it frequently occurs as a result of inconsiderate handling methods. In a cooking context, the term refers to the transfer of contaminants from a surface, object, or person to food. Cross-contamination most frequently refers to biological contamination, though it can also be physical or chemical. Cross-contamination in the food industry frequently happens because of:

- food handlers (such as bacteria from perspiration, sneezing or coughing, hands, hair, or clothing)
- incorrect methods for handling food (e.g., reusing cutting boards or utensils for raw and cooked food or for different types of food)
- improper sanitizing and cleaning (e.g., not properly rinsing cleaning chemicals from preparation surfaces, dishware, glassware, or equipment)
- inadequate food storage (e.g., storing raw meat on shelves above ready-to-eat food)
- inappropriate dumping of rubbish (e.g., allowing garbage containers to overflow) and insects

1.4 Route of transmission of food safety

Too far, more than 250 distinct foodborne diseases have been identified, impacting almost one-third of the world's population each year. The asymptomatic presentation of some illnesses, international heterogeneities in reporting, and the different transmission routes of certain infections are all factors that contribute to the underreporting and underestimation of the frequency of foodborne diseases. Globalization, centralization of the food supply, transportation of food products further away from their origins, and the numerous phases where contamination can occur have made investigating foodborne and waterborne outbreaks more difficult [8].

Some foodborne pathogens are transmitted directly from animals to people, while others are conveyed by vectors such as insects, food handlers, contaminated food products or food-processing surfaces, or transmission via sponges, towels, or utensils. Furthermore, the airborne pathway may play a role in the spread of several foodborne diseases. Multiple transmission channels have been documented for various foodborne diseases, complicating epidemiological investigations.

1.4.1 Types of transmission barriers

Foodborne infections have been described in a variety of ways, each of which offers potential for preventing and controlling epidemics.

The first line of defense

The most successful sites of preventive intervention are those that prevent pathogen entry into the environment, while secondary barriers keep pathogens that have already entered the environment from multiplying and spreading.

Second line of defense

The phenomenon of superspreading, which relates to the concept that at the population level, a minority of hosts is responsible for the bulk of transmission events, makes it difficult to understand pathogen dynamics, monitor transmission, and adopt preventive measures (**Figure 1**).

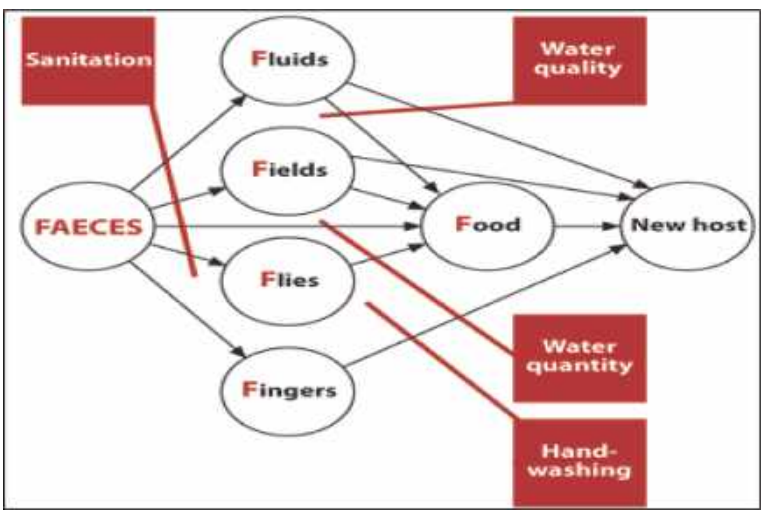


Figure 1.
The F-diagram in the food safety and sanitation system.

1.5 Economic benefits and public health in food safety system

Food safety plays a significant role in the national economy and health by; safeguarding the health of the nation through improved nutrition, enhancing national and international trade, preventing avoidable losses at pre/post-harvest, and reducing public health costs by decreasing foodborne illness and reducing export and trade barriers, resulting in countries becoming competitive in the global trade [9].

Preventing unnecessary losses at pre- and post-harvest, enhancing national and international trade, lowering public health costs by reducing food-borne illness, and lowering export and trade barriers all contribute to food safety's importance to the national economy and health. These factors make countries more competitive in the global market.

Everyone is at risk due to the global health issue of contaminated food. Infants, young children, expectant mothers, the elderly, and people with underlying medical conditions are all in danger. 220 million children experience diarrhea each year, and 96,000 of them pass away. Foodborne disease puts the most vulnerable people's nutritional status in danger by feeding a vicious cycle of diarrhea and malnutrition. An estimated 48 million illnesses and 3000 fatalities from foodborne illnesses are attributed to improper handling each year [5].

Food can be contaminated at any moment during production and distribution, and food producers bear the major responsibility. Foods incorrectly prepared or mistreated at home, in food service establishments, or at markets, however, generate a major proportion of foodborne disease occurrences. Not all food handlers and consumers are aware of their responsibilities, such as following fundamental hygienic standards when buying, selling, and preparing food in order to protect their own and the community's health. Public health and food safety continue to be significantly impacted by local and international food marketing. As food supply networks cross more borders, health concerns are becoming more globally dispersed [10].

1.6 The elemental principles of food safety and tools

A technique for evaluating and controlling some of the hazards to the health and safety of raw agricultural products that arise from their cultivation, harvesting, transportation, storage, and handling on the farm is the adoption of good agricultural practices (GAPs). The modules on storage, transportation, and house packing are more properly known as good handling techniques and are applicable in nonfarm contexts, as well as farms (GHP). Buyers have different needs for the audit certification of suppliers; some only want certain farm module components, while others only want GHP certification, and still, others want both GAP and GHP [5].

From farm to fork, food safety testing is undertaken, including official regulations by national food safety authorities. Food safety programs are concerned with the conditions and actions that aid in the preservation of food quality by preventing unintentional contamination. They wish to stay away from food poisoning and contamination. In the EU's food safety initiatives, HACCP ideas are employed. Hazard analysis and critical control points, or HACCP, is a system for detecting, assessing, and controlling food safety concerns.

On the other hand, good manufacturing procedures are the fundamental instrument used to measure food safety in the food processing industries. In the manufacturing industry, good manufacturing practices (GMPs) are comprehensive; they cover every facet of each operation to eliminate hazards that might arise

anywhere in the supply chain or manufacturing environment. With sound operational practices, they seek to uphold the integrity of products and guarantee that the highest standards are fulfilled at each stage, from testing and development to storage [11].

The 4C's fundamental principles of food safety and hygiene may be thought-about as improvement, cross-contamination, chilling, and preparation. As a food business, it is vital to uphold principles like these to make sure your food follow is safe and healthful.

1.6.1 Cleaning

Ensure that you clean and make clean the world and instrumentality that goes to be used totally. This is confirmed often done between every preparation task that takes place, and before you begin the day and end the day. Ensure you have high personal hygiene standards if you are handling food, for instance, your hands' square measure totally washed, garments square measure clean, your hair is tied back, and gloves square measure worn once handling food.

1.6.2 Cross-contamination

This happens once pathogens from one kind of food transfer to a different kind of food, which ought to be unbroken and separate. Hands, instrumentality, and surfaces will enable germs to unfold between foods. Make sure that instrumentality and surfaces square measure totally clean between foods that should be unbroken separate. For instance, it is desirable to keep meat and vegetables separate once stored, and to thoroughly wash all equipment used while preparing various types of food.

1.6.3 Chilling

Food should be kept intact between 0°C and 5°C if it needs to be refrigerated. Consequently, refrigerators should be set at 3°C or 4°C. As soon as the food is delivered and before the use-by date has gone, it should be frozen. If possible, defrost it in the electric refrigerator, where it will be kept at a safe temperature, or in a very tightly packed device submerged in cold running water. A microwave's unthaw mode can also be used. Ensure that the food has fully defrosted before cooking it unless the maker specifically directed you to cook from frozen.

1.6.4 Cooking

To ensure that all microorganisms are safely destroyed during preparation, food must achieve a core temperature of 75°C or 70°C for at least two minutes. When preparing meat, make sure that juices run clear, there is no pink meat left, and it is reached a core temperature of 75°C or 70°C for a minimum of a pair of minutes. A clean measuring instrument or probe can enable you to see this. Hot food that is being held back should be unbroken at 63°C or on top of, similar to a buffet. If food has not been used within 2 hours, it ought to either be uneaten to piping hot or chilled to 8°C or below. If the food has been neglected for over 2 hours, it should be thrown away for safety.

2. Current challenges of food safety issues

Because some microorganisms have shown resistance to food preparation and storage strategies, as antibiotics, the medical profession and also the food business have become progressively involved. Consumers, on the opposite hand, seldom regard their own food safety measures to be a risk. They still see agricultural chemicals, pesticides, and animal medications as a key supply of concern. As a result, some microorganisms have shown resistance to food preparation and storage strategies, as antibiotics, the medical profession and also the food business have become progressively involved. Consumers, on the opposite hand, seldom regard their own food safety measures to be a risk. They still see agricultural chemicals, pesticides, and animal medications as a key supply of concern [12]. The most vital challenges square measure as follows:

- Inadequate infrastructure for food safety regulation and social control.
- Inadequate technical and restrictive conformity assessment.
- Inspections square measure difficult thanks to the big range of food producers, processors, merchants, and retailers distributed around the country.

2.1 Food safety challenges in the global supply chain

Consumer need for more variety through year-round produce, ethnic foods, and creative and organic foods, combined with industry's aim for better productivity through low-cost sourcing (and consumer demand for safe and affordable meals) has fueled a surge in global food sourcing. Add to that the continued population expansion and improving economies, in some developing countries, and food safety issues begin to appear.

Economic, environmental, and social variables all play a role in the global food supply chain. Each of them has unique issues, which are explored further below.

2.1.1 Economic factors

Land and labor: Both are less expensive in developing countries, though the gap with developed countries is narrowing. In developing countries, construction and land prices are still low, allowing corporations to build manufacturing facilities for less than a tenth of the cost in developed countries.

2.1.2 Emerging economies

Large countries such as China and India continue to have an impact on supply chain globalization. However, rising affluence in emerging economies, combined with worldwide expansion of food service and retail enterprises, appears to be causing a convergence in food consumption patterns. This usually means that food spending rises as a result of the purchase of more calories, which are typically found in higher-priced items. Because meat and dairy products are regarded as a luxury in low-income countries, their diets are often high in starchy vegetables and low in animal protein. Income growth, combined with the fast expansion of international retail and food

service chains, has resulted in a convergence of spending patterns. This transformation is taking place at a far faster rate than in earlier centuries.

Before the 1980s, for example, Latin America's national retail food sales as a percentage of total food consumption were 15–30%. It had risen to 50–70 percent by 2001. In just 20 years, the country had grown as much as the United States had grown in 50 years. Food consumption patterns throughout Asia are similar. Economic expansion is accompanied by rising urbanization, with around one million people relocating from rural to urban areas every week, where there is a greater need for labor and where intense construction of homes, manufacturing facilities, and municipal infrastructure is taking place.

2.1.3 Environmental factors

Expansion of pathogens, shrinking arable land, climate change, water scarcity, and limited fossil fuel are only a few examples of environmental factors.

2.1.4 Expansion of pathogen range

There were just four important foodborne pathogens recognized 50 years ago: Staphylococcus aureus, Salmonella spp., Clostridium botulinum, and Clostridium perfringens. There are almost 30 foodborne pathogens recognized today, including bacteria, viruses, protozoans, and prions [13].

Pathogens are spread and have their typical ranges expanded for a variety of reasons. These include the quick global movement of enormous amounts of people, animals, and crops made possible by modern transportation networks, as well as the spread of exotic plant and animal species and zoonotic diseases. When microorganisms are exposed to new habitats, their well-known capacity to mutate and adapt to shifting environmental conditions is accelerated.

Due to changing temperatures and weather patterns, illnesses and their vectors are spreading from tropical to temperate regions as the globe warms. People are greatly strained by poverty, violence, and malnutrition, which increases their susceptibility to infectious diseases. And also, a lack of political will to take effective environmental and human health protection measures at the municipal, state, and federal levels.

2.1.5 Decreasing arable land

The loss of cropland due to rising urbanization did not appear to have a significant influence on agriculture in emerging countries since changes were so gradual. When vast numbers of people in rural parts of those countries needed jobs, labor-intensive farming was acceptable.

However, to compensate for the loss of land caused by urbanization, more efficient Western-style agricultural methods will be required today. Increased agricultural production efficiency will dispense with even more farm employees, hastening the urbanization trend. Desertification and a growing scarcity of water for crop irrigation will result in the loss of arable land. Biotechnology advances in the development of drought-resistant crops may assist to alleviate this problem. Sub-Saharan Africa and South America are the principal regions that have a surplus of arable land. These places will be vital to ensure an adequate global food supply when combined with their generally adequate rainfall; nevertheless, the possible impact of climate change may need to be considered.

2.1.6 Social factors

Overpopulation, waste food, an increase in the number of immunocompromised persons, year-round sourcing, higher living standards, and changes in retailing and customer behavior are all examples of socioeconomic variables that contribute to the food safety issue.

2.1.7 Human overpopulation

The world's population has surpassed 7 billion people and is anticipated to exceed 11 billion by 2100. Many countries, both developing and developed, will be unable to feed their own citizens. This will promote the need for more global food trade, which will be driven by genuine necessity rather than solely by decreased labor costs and consumer demand for variety.

The reasons behind the increase in foodborne illness incidence

- **It is important to recognize the identification and improved methods for detecting foodborne diseases.**
    - Better methods for detecting and identifying foodborne sickness and the organism that may be the illness are now possible thanks to advances in science and technology.
    - Foodborne disease has traditionally been attributed to "unknown" sources.
- **Antibiotic resistance is growing in microorganisms.**
    - They are adapting to environmental changes that endanger their existence.
- **A shift in the consumer population**
    - Changing family structures, including a rise in two-earner households, the number of women working, and single-head households.
    - Immunosuppressed individuals are on the rise, including those with HIV, those receiving chemotherapy, those having organ transplants, and those suffering from long-term chronic conditions.
- **Modification of consumer lifestyles**
    - A desire for meals with a fresh flavor and little packaging and processing.
    - more appliances, such as food processors and microwaves, reduce labor-intensive food preparation.
    - understanding the fundamentals of food safety.
    - Only a minimal amount of time is dedicated to household meal preparation tasks.

- Instead of handling and preparing food properly, they place more value on convenience and saving time [14].
- The majority of meals are consumed away from home.

- **Farm to table changes in the food system.**
  - To meet consumer demand for a wide variety of foods, particularly fruits and vegetables, a global food industry and quick transportation system have emerged.
  - Consolidation of small animal processing and slaughter operations into a single, large operation with a central location.
  - In response to consumer demand, the food processing industry has created novel packaging ideas, processing methods, and distribution plans that may pose new threats to food safety.
  - Foodservice operators, retail grocers, and food processors are no longer distinct categories. For instance, supermarkets might have a range of ready-to-eat meals that customers can enjoy at home.

2.2 Emerging method and technological detection of a food safety issue

Public health worries about food safety have recently increased significantly over the world. The frequency of foodborne illness has sharply increased [15]. According to the World Health Organization [16], diarrheal diseases caused by contaminated food or water kill almost two billion people each year and nearly 30% of children under the age of five [16, 17].

Food security and sustainable development are reinforced by reliable food supply, which also promotes international trade and tourism. The number of individuals purchasing and consuming food made in public spaces has increased as a result of urbanization and changes in consumer behaviors, particularly travel. A longer and more complicated global food chain is the outcome of the growing consumer demand for a larger variety of foods, which has been sparked by globalization. The intensification and industrialization of agriculture and animal production to fulfill the rising need for food present both opportunities and difficulties for food safety as the world's population rises. Climate change is foreseen to have an impact on food safety [18].

In order to ensure food safety, manufacturers and handlers of food are being held more accountable. Due to the speed and breadth of product distribution, local events can swiftly turn into international emergencies. In the past ten years, there have been serious outbreaks of foodborne illness on every continent, which are frequently exacerbated by global trade. The best method to reduce risk factors for food contamination is to demonstrate consistency in implementing, monitoring, and enforcing food safety-focused functions and operations [19].

Recent advances in point-of-care (POC) diagnostic techniques for food safety applications are:

1. Paper-based devices

2. Colorimetric devices

3. Fluorescence detection

4. Electrochemical detection

5. Other detection methods

6. Chip-based devices

Numerous novel nanomaterials have been investigated for use in sensing and food safety applications. The advantages of employing noble metal nanoparticles (such as AuNP and AgNP), carbon-based nanomaterials (such as graphene and GO), and MIPs have also frequently been documented [20, 21], specifically the capacity to generate significant signal amplification and enhancement with good selectivity exploring novel nanomaterials, such black phosphorus, would be advantageous because of their intriguing characteristics, like direct bandgap, strong structural and functional anisotropy, high conductivity, and electron transfer capacity [22], which could greatly increase the detection sensitivity. In reality, more in-depth knowledge of these materials' underlying chemical, structural, and physical characteristics might enable their engineering to generate substrates that are more biocompatible. It is also important to verify these materials' stability to assure their dependability and robustness.

3. Foodborne disease (FBD) impacts on food safety

A person who consumes contaminated food may develop a foodborne illness. It is possible that the food was improperly cooked, improperly stored, or infested with vermin. Different names for the resultant illness include food poisoning, food-borne illness, and food-borne infection [23]. Foodborne diseases can be defined as those conditions that are commonly transmitted through ingested food. Foodborne diseases comprise a broad group of illnesses caused by microbial pathogens, parasites, chemical contaminants, toxins, and other hazards. The causes of foodborne disease are: Food from unsafe sources, inadequate cooking, improper holding temperature, contaminated equipment, poor personal hygiene (not washing hands), sick stick person/individual should be notified like vomiting, diarrhea, jaundice, and sore throat with a fever, and any food can cause food-borne illness should be identified (**Table 3**).

Nature and extent of food safety risks in developing countries. The consumers are concerned about foodborne diseases, most of the known burden of FBD disease comes from biological hazards, and most foodborne diseases are the result of consumption of fresh, perishable foods sold in informal markets. Therefore, 10% of the diarrheal burden is due to foodborne disease resulting from bacteria and viruses, while 40% of diarrhea with attributed to water, sanitation, or hygiene (**Figure 2**).

Foodborne disease matters for development. It is a significant public health issue. Both nations that want to export and smallholder farmers who want to sell their produce in high-value domestic markets face obstacles as a result of it. Consumers are also quite concerned about it. In fresh foods and vegetables from animal sources, parasites, protozoa, bacteria, and viruses account for the majority of the known health

Types of foodborne	Common sources
E. coli	Undercooked ground beef
Hepatitis A	Feces (human waste) from improper hand washing
Salmonella	Raw poultry and eggs
Staphylococci (Staph)	Human mucous (coughing/sneezing)
Norovirus	Infected food handler
Clostridium perfringens	Time and temperature abused foods
Campylobacter SPP	Unpasteurized milk and contaminated water

Table 3.
Types of foodborne disease illness.

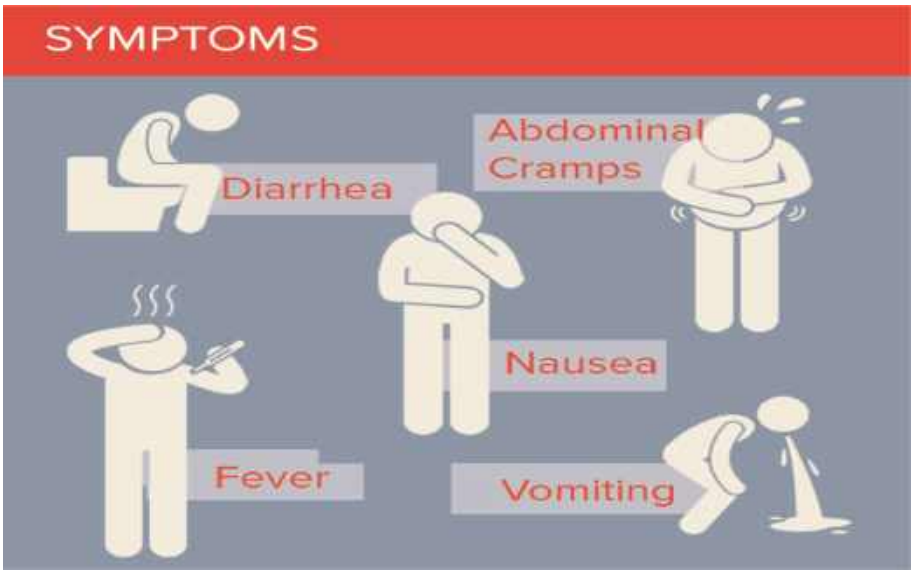


Figure 2.
Characteristics of foodborne disease. Source: [22].

burden of foodborne disease. Regarding the effects of chemicals and fungal toxins in food on human health, there are also significant worries but significant evidentiary gaps. For example, in developing countries like Ethiopia, the burden of foodborne disease is not known but experts believe that developing countries bear the brunt of foodborne disease [24].

- high levels of hazards are often reported in developing country food [25].
- high prevalence of potentially foodborne pathogens is found in hospital and community surveys of children and adults with diarrhea [26]. Lack of clean water for washing food and utensils is common (around 750 million people do not have access to clean water) [27]; and the use of human sewage or animal waste for horticulture production is common in developing countries.

3.1 Mechanism of preventing foodborne disease

According to the Center for Disease Control and Prevention (CDC), approximately 1 in 6 Americans (48 million people) get sick, 128,000 are admitted to hospitals, and 3000 are away each year as a result of foodborne illnesses. Foodborne sickness symptoms can range from minor to severe and even fatal, and they include upset stomach, abdominal cramps, nausea, vomiting, diarrhea, fever, and dehydration. Anyone who consumes contaminated food can become ill from a foodborne illness, although some groups are more prone to getting sick and having a more severe sickness [28].

These groups include young children, the elderly, women who are expecting, those who are immunologically weakened, and those who are pregnant (e.g., cancer patients, and diabetics). Understanding how food becomes hazardous to consume and what preventative steps may be performed to keep food safe are essential for preventing foodborne illness. Follow these 4 simple steps to keep food safe: Clean (wash hands and food contact), separate (prevent cross-contamination), cook (combination of time and temperature), and chill (store at low storage temperature) and application of bioactive substance is another a vital. Implementing strict food quality standards can help lower the chance that the personnel or consumers will come into contact with a foodborne illness.

3.1.1 Respect for the law

As well as implementing best practices should be informed of the pertinent laws and standards in addition to following the best practices for food hygiene. At all times, you must abide by these. HACCP and the HARPC standards or municipal laws should be familiar to you and your personnel. Study international norms as well, such as those created by the World Health Organization.

3.1.2 Correct food-handling procedures

It makes sense that safeguarding food is essential for stopping foodborne illnesses. Ensure that all employees have received training in proper food handling techniques, such as how to distinguish between raw and cooked meats. If not, the raw food's bacteria and viruses could transfer to the cooked, eaten food. Use extreme hygiene precautions when handling food. Consult the appropriate regulations if you are unsure. For instance, all areas used for preparing and serving food must be cleaned and sanitized. Likewise, use caution when cleaning surfaces with water. The transmission of disease will be facilitated if the water source is contaminated.

Make sure that all food is properly stored. Keeping food at the proper temperature will prevent the growth of microorganisms that might cause food poisoning. Additionally, keep in mind that not all meals.

3.1.3 Strict control of pests

A food industry must take strict pest control procedures. Pests can raise the danger of contracting a foodborne illness. Some pests, such as cockroaches, rats, and flies, can transmit diseases through their droppings. Or other, they might have harmful microbes on their bodies. Microorganisms move around your property at the same rate as pests.

3.1.4 Very good hand hygiene

Must keep your hands clean whenever you handle food. The finest tool for preventing food-borne illnesses is good hand hygiene. The disease will be spread through contaminated hands.

4. Conclusion

As new preferences, cuisines, and food processing methods arise, continued globalization of food production and transportation, as well as increased global travel, will create more challenges. Simultaneously, food safety duty is shifting from the ultimate chef or consumer to the entire food chain. While consumer education about food safety is crucial, more consumers are likely to want safer food in the first place. The food industry as a whole will be more involved in setting food safety policies and standards. Food-borne pathogens represent one of the major challenges for all stakeholders in the food chain. Implementing good hygiene practices (GHPs) and hazard analysis and critical control points (HACCP) is utilized as a preventive technique in the food industry to assure the microbiological safety of food. However, proper controls are important to assure the safety of food along the entire food chain as microbiological safety is a necessity for commercialization of foods. Exciting advancements have taken place in the field of food microbiology and safety in the previous two decades.

Technology is developing quickly, and next-generation assays like biosensors and DNA chips have already been created. These assays may someday be able to monitor various pathogens in food in close to real-time and online. Food pathogen detection kits for home use and rapid food spoilage detection kits appear to be feasible. Rapid methods and automation in microbiology have a lot of potentials, and both immediate and long-term improvements will undoubtedly be very fascinating.

5. Recommendation

- Construct and maintain suitable food systems and infrastructures (such as laboratories) to respond to and manage food safety threats across the food chain, especially during emergencies.

- An important instrument for managing food safety hazards is to improve national food systems and legislative frameworks, as well as to install suitable infrastructure.

- Encourage cross-sector collaboration between public health, food technologist, animal health, agriculture, and other sectors to improve communication and coordination.

- Food safety should be integrated into broader food policies and programs (for example, nutrition and food security).

- Food safety should be promoted through a systematic illness prevention and awareness program, as well as advocacy for food safety as an important

component of health security and the integration of food safety into national policies and programs in accordance with international health regulations.

- Providing independent scientific assessments of microbiological and chemical dangers that serve as the foundation for international food standards, guidelines, and recommendations, known as the Codex Alimentarius, to assure food safety worldwide.

- To ensure that food produced across the country is safe when imported into other countries and to work closely with international organizations to ensure food safety along the full food chain, from production to consumption.

- Corrective action and collaborative platform among policymakers and legislation, harmonization and alignment of standards, involvement of civil society, and enforcement should be strengthening.

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