# Food Safety and Security: Protecting Public Health and Ensuring Access to Nutritious Food

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## Abstract

Food safety and security are critical public health issues because it addresses the twin problems of access to sufficient nutrition and protection against contamination. Global issues such as population growth, climate change, urbanization, and resource scarcity aggravate these problems and necessitate innovative, adaptive approaches. Foodborne illnesses and malnutrition remain widespread, disproportionately affecting vulnerable populations. These include climate-smart agriculture, blockchain, and WGS, which are said to transform the world since they enhance traceability and resilience in agriculture and offer improved control of diseases. As a matter of fact, WGS allows for the direct identification of pathogens, but blockchain provides transparency in supply chains. Still, because of the very high implementation costs in resource-poor low and middle-income countries, adaptation will not be widespread and hence necessitates collaborative efforts between governments, researchers, and communities. Stronger institutional frameworks, greater investment in technological innovations, and greater international cooperation could improve the sustainability and equity of food systems. As will be shown throughout this chapter, food safety and security measures do not only promote nutrition better but also aid in preventing public health crises when seeking stronger, sustainable communities around the world.

**Keywords:** Food safety, Food security, Public health, Nutritional needs, Sustainable food systems

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## Introduction

By 2050, it is estimated that the population will have hit 9.7 billion, hence raising the problem of achieving access to safe, healthy, and wholesome food (Ngalim et al., 2024). Food safety and security is important to the public, yet millions of people worldwide face hunger, malnutrition, and food-borne illnesses caused by the natural hazards of climate change and human factors such as urbanization and globalization. Interdependence of food safety and food security reveals collective importance in public health: unhealthy food spreads disease, amplifies malnutrition, and accelerates vulnerability to long-term health problems; on the other hand, food insecurity makes people eat low quality or contaminated food, a vicious cycle of poor health and economic burden. It is important to break this vicious cycle through the adoption of holistic methods that include safety standards and accessible nutrient-dense food. This approach serves as a protection against foodborne diseases and in shaping healthier and more resilient populations food (Helfi et al., 2023).

### Food Safety: A Global Health Concern

The three significant elements of food safety include handling, preparation, and storage of food to avoid contamination and foodborne illness, which can be classified as scientific disciplines (Gallo et al., 2021). This also helps to maintain the quality of food. Ample amounts of safe, nutrient-dense food is required to sustain life and promote good health Food safety is essential to public health in that it ensures that the food consumed is devoid of hazardous pollutants that could bring about disease or harm (Garcia et al., 2020). It involves monitoring hazards, applying rules, harnessing the breakthroughs of technology, and limiting the effect of foodborne infections. In understanding and addressing these issues, consumers will be safe, and confidence in the global food supply chain will be enhanced.

### Main Hazards in Food Safety

Food safety hazards fall into three primary categories: biological, chemical, and physical.

1) **Biological Hazards**

Food-borne infections are caused more frequently by bacteria (*Salmonella, E. coli*), viruses (*Norovirus, Hepatitis A*), and parasites (*Giardia, Toxoplasma*). Most of these bacteria thrive only in conditions created by the improper handling, storage, or cooking of food products (Table 1) (Gallo et al., 2020).

2) **Chemical Hazards**

Pesticides, industrial pollutants, food additives, and natural toxins such as mycotoxins all have chemical dangers. Long-term exposure leads to chronic illnesses, including cancer and neurological disorders. The rules are strict, but in enforcement gaps, communities fall open. Over time, changes in the organoleptic properties of meals exposed to air at room temperature might be the root cause of illnesses and conditions that most commonly affect the digestive system (Table 1) (Pettoello-Mantovani & Olivieri, 2022).

3) **Physical Hazards**

Some of the physical pollutants that enter the food supply during processing and packaging include metal fragments, glass shards, and plastic bits. These can cause injury or harm to customers, and thus require high quality control procedures (Table 1).

**Table 1:** Types of hazards in food safety

| Biological | Chemical | Physical | |
|---|---|---|---|
| Bacteria | Pesticides | Naturally present in foods | Handling/processing materials |
| Viruses | Processing Chemicals | Bones | Glass |
| Parasites | Drug Residue | Pits | Metal |
| Molds | Allergens | Bugs | Hair |

(Kamboj et al., 2020)

**Factors that Play Roles in Emerging Foodborne Diseases**

Microbes may change over time, becoming more potent or resistant to medicines. Climate change may also favor their survival in new places and increase the potential of spreading them.

Globalization and the complexity of food systems have added risks. Newer food types and complex supply chains increase the likelihood of contamination at various points. Poor sanitation with inadequate food safety results in higher prevalence of foodborne diseases (Anis & Norfarizan-Hanoon, 2022). Food gets contaminated as a result of inadequate or unhygienic cleaning water, disposal of wastes, and lack of refrigerator facilities. In some countries, chemical and waste pollutions can contaminate food. Consuming raw or undercooked meat, seafood, or unpasteurized milk raises the chances of becoming ill. Food and its by-products also are hazardous if vegetables and fruits, especially vegetables, are consumed without properly washing them before eating or handling. When people move to other places, or even when people travel, they can introduce new pathogens into an area. Then outbreaks occur because people in a particular area have not previously been exposed to those germs. The movement of food, feed, and live animals across the globe makes it even easier for diseases to be dispersed. Contaminated foods are shipped to other nations, and animals are transported that carry diseases to the human population. Fruits and vegetables, which are usually consumed raw, are increasingly becoming a common source of foodborne illness (Pettoello-Mantovani & Olivieri, 2022). Contamination can occur at the growing, processing, or transport stages, especially if the water or fertilizers used are contaminated.

**Critical Points of Contamination**

Food safety guarantees that there are no risks to the general public's health. Throughout the supply chain, contamination can happen during cultivation, processing, shipping, retail, and consumption, among other stages. There are serious threats from physical hazards like foreign objects, chemical toxins like pesticides, and biological hazards like germs and viruses (Figure 1).

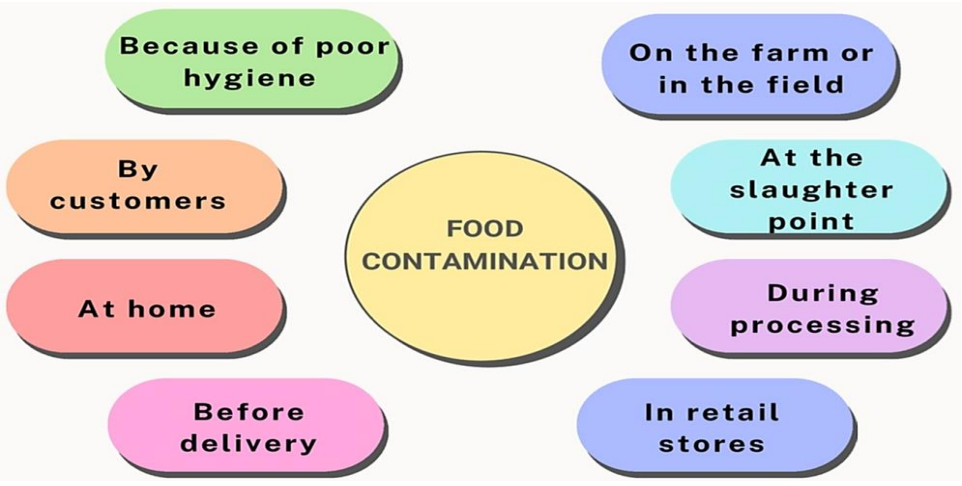


**Fig. 1:** Key stages in the food supply chain where contamination can occur (Retrieved from biorender)

**Impact of Foodborne Illnesses**

Foodborne illnesses create considerable burdens on public health care systems and economies of almost all the world, striking millions of people each year. Symptoms of foodborne diseases may be from moderate gastrointestinal disturbances to more critical conditions, such as neurological disorders or renal failure induced by *E. coli*. Children, pregnant women, and elderly individuals fall within these classes that are likely to experience adverse effects or death. The CDC estimated that acute foodborne infections cause 47.8 million illnesses every year in the

United States, 138,000 hospitalizations, and 3000 fatalities (Bintsis, 2017). Food recalls, lost productivity, and medical costs related to foodborne diseases run into billions of dollars per annum. According to the CDC and prevention, annually 48 million Americans suffer from foodborne illnesses that account for 128,000 hospital admissions and 3,000 deaths (Corsetti et al., 2023). Foodborne infections are more common in the developing countries because of limited infrastructure and availability of healthy food in such regions. The report from the WHO says, "600 million cases occur every year, which further leads to 420,000 deaths, resulting due to contaminated foods" (Ngalim et al., 2024).

**Global and National Frameworks for Ensuring Food Safety**

International bodies and governments have put in place strong frameworks to ensure food safety from production to consumption. The global food safety standards are provided by the Codex Alimetarius, which was created by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO). It ensures uniformity in the process of international trade and food safety. To ensure protection to consumers, the laws are implemented by nations. For instance, to avoid food safety hazards, the U.S. Food Safety Modernization Act has given powers to the Food and Drug Administration (FDA). The European Food Safety Authority is also tasked with monitoring compliance with very tight regulations within the European Union. A private certifications like ISO 22000 and Hazard Analysis and Critical Control Points (HACCP) are commonly utilized in order to enhance food safety procedures to ensure that compliance with international standards is maintained (Rohini et al., 2020).

**Technological Innovations in Food Safety**

Food safety has been revolutionized through technological innovations, with enhanced detection, prevention, and management of hazards. Due to the fact that blockchain technology offers end-to-end traceability, it completely changes the food supply chain. This reduces the intensity of outbreaks since it ensures timely intervention in case of contamination incidents. With new instruments such as biosensors and PCR assays, dangerous goods are identified rapidly; hence, exposure is limited (Toromade et al., 2024). Organic farming and integrated pest management instead of dangerous pesticides make food systems safer and more sustainable. Today, companies focus on developing a robust food safety culture through education and awareness initiatives. It lowers hazards throughout the handling and production process by encouraging workers to put safety first.

**Food Security: Ensuring Access to Nutritious Food**

Food security is the guarantee that people have access to enough wholesome food to fulfill their nutritional needs and support a healthy lifestyle (Herforth et al., 2020). Sadly, food insecurity is still a major problem, with around 700 million people going hungry every day (Gerlach, 2024). Food security has been impacted by climate change, population growth, rising food prices, and other environmental issues for more than ten years. Many people may find it difficult to get food that satisfies their nutritional needs; therefore, food insecurity for them entails both a lack of quantity and a lack of quality. The four interconnected pillars of availability, access, use, and stability form the foundation of this idea. Food security is nevertheless threatened by a number of issues, such as poverty, conflict, and climate change, despite international efforts. WHO recognizes food security as a critical concern and actively works towards addressing the challenges of hunger, food insecurity, and malnutrition.

**The Four Pillars of Food Security**

**1. Availability**

The physical presence of enough amounts of food through production, distribution, and commerce is referred to as food availability. Global trade networks, effective supply chains, and sustainable farming methods are essential. In rural regions especially, local farming is essential to guaranteeing a consistent supply of food. However, problems including monoculture dependence, water shortages, and soil deterioration might restrict production. Food imports support local production, particularly in nations with small agricultural capacities. Food shortages, however, can be made worse by trade interruptions, such those that occurred during the COVID-19 epidemic (Figure 2) (Mbow et al., 2019).

**2. Access**

The capacity of people to get food through financial resources (money, jobs) or social support networks is referred to as food access. Due to poverty or inequality, many individuals cannot get food, even if it is accessible (Yenerall et al., 2021). Because they frequently spend a disproportionate amount of their money on food, low-income households are more susceptible to changes in prices. Particularly in rural or war-torn areas, physical access to markets and food supply may be restricted by geographic obstacles, inadequate infrastructure, and conflicts (Figure 2).

**3. Utilization**

The capacity to prepare, eat, and absorb nutrients from food is the main emphasis of utilization. Food safety, nutritional quality, and access to sanitary facilities and medical treatment are all important factors. In order to combat malnutrition and diet-related illnesses like diabetes and obesity, a balanced diet is essential. In order to avoid malnutrition, promote better mental and physical health outcomes, support physical and cognitive development, and lessen health inequities, food security is crucial for both public health and nutrition. Reducing food insecurity is essential to advancing people's and communities' general well-being. Communities may become healthier and more resilient by addressing food security and improving public health outcomes (Khansa Nur Fathiya, 2024).

Food that is contaminated or ruined compromises health, underscoring the significance of appropriate storage, cleanliness, and instruction. Insufficient access to nutritious food can weaken the immune system, increasing individuals' vulnerability to infections and diseases (BMC, 2023). Because illnesses like diarrhea impair the body's capacity to absorb nutrients, under nutrition is made worse by a lack of access to clean water and sanitary facilities (Figure 2).

4**. Stability**

Stability guards against short-term shocks like natural catastrophes, economic downturns, or wars by guaranteeing steady availability to food over time. Food security needs to be able to withstand changes in availability, accessibility, or use. Food production and distribution are disrupted by climate change, which makes droughts, floods, and storms more frequent and intense. The devaluations of currencies, unemployment, and inflation lower purchasing power, which restricts access to food. The food systems are upset by war and displacement, which frequently results in famine and long-term food insecurity (Figure 2).

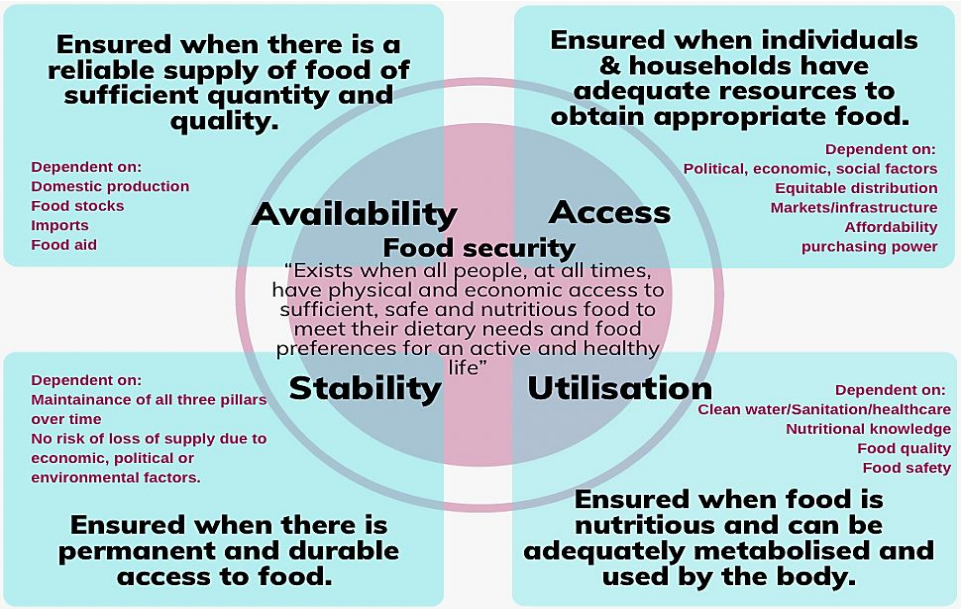


**Fig. 2:** Pillars, determinants and factors effecting food security (Retrieved from biorender).

**Challenges to Food Security**

Despite the advancements in technology and agriculture, global food security faces significant challenges. The biggest cause of food insecurity is still poverty. More over 700 million people were living in extreme poverty in 2023, finding it difficult to pay for necessities like food. Because excluded populations frequently lack access to resources, markets, and opportunities, economic disparity makes the issue worse. The report indicates that about 258 million people in 58 countries and territories experienced acute food insecurity at crisis or worse levels (IPC/CH Phase 3-5) in 2022. This is an increase from 193 million people in 53 countries and territories in 2021 (Kalle Hirvonen & Elia Machado, 2024).

Armed wars cut off access to food by displacing millions of people, destroying infrastructure, and disrupting food production. Food insecurity brought on by conflict has gotten to crisis proportions in places like Yemen, Syria, and the Horn of Africa. Internally displaced individuals and refugees frequently rely on humanitarian help, which is either insufficient or inconsistent. Food security is being threatened by climate change since it is upsetting agricultural systems. Extreme weather events, unpredictable rainfall, and rising temperatures all imperil livestock, lower agricultural production, and deplete water supplies. Particularly at risk are smallholder farmers, who provide a sizable amount of the food produced worldwide. While floods devastate infrastructure and agriculture, prolonged droughts lower agricultural output and animal survivability. When growing seasons change, staple crops like maize, rice, and wheat become less viable, this reduces output and causes food shortages. Food security has suffered as a result of climate change, which has increased the frequency and severity of severe events and reduced agricultural yields (Hendriks et al., 2023).

By 2050, there will be 10 billion people on the planet, which will result in a 70% increase in the need for food. Rapid urbanization puts additional strain on natural resources and agricultural systems by changing consumption trends toward processed and resource-intensive commodities. An estimated 1.3 billion tons of food are wasted every year, or one-third of the world's total food production. Food waste happens at the consumer level, whereas food loss happens during manufacturing and transportation (Figure 3). The consumption of unsafe foods costs low- and middle income countries at least US$ 110 billion in lost productivity and medical expenses annually (Rohini et al., 2020).

**Solutions for Enhancing Food Security**

Targeted interventions, innovative solutions, and coordinated global efforts can all help achieve food security. The necessary climate-resilient agricultural methods include water-efficient irrigation systems, agro-forestry, and crop diversity. It will be important to make technological investments to boost output and decrease post-harvest losses in response to changing weather conditions. To fight food crises, the world requires allies in the form of international organizations like the WFP and the FAO. These relationships among governmental, private, and non-governmental agencies can create resilient food systems (Watzke & Bruce German, 2024). Increasing consumer awareness on issues such as food waste must also be accompanied by practices for improving storage and transport practices that reduce losses along the way from production to the end point of consumption. Improved roads, better storage facilities, and greater access to markets should help improve food delivery to underserved and rural areas. Policies like school feeding programs, monetary transfers, and food subsidies are necessary for expanding access for the poor. Safety nets must be strengthened to cushion shocks resulting from economic and natural shocks.

Nowadays, it has been found that between 25 to 30 percent of food produced are lost or wasted (Mbow et al., 2019), translating to 25% of the area, water and fertilizers needed to raise crops (Bolaños-Palmieri et al., 2021). The best ways to guarantee food security and avoid unpleasant consequences are to ask about the basics of food production and to prepare food at home correctly without disregarding important instructions and label information that allows the detection of the presence of substances that may cause allergies or intolerances, as well as the product's expiration date (Figure 4).

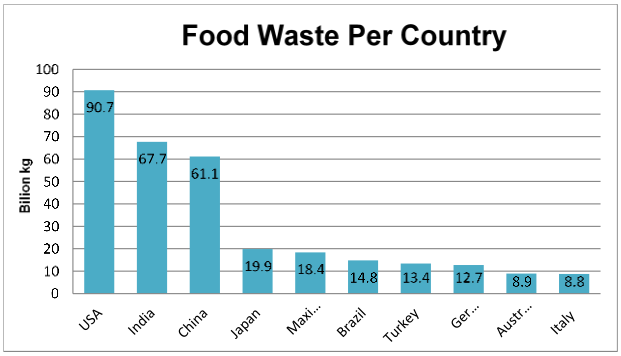


**Fig. 3:** Food waste statistics in different countries (UNEP) (Retrieved from biorender)

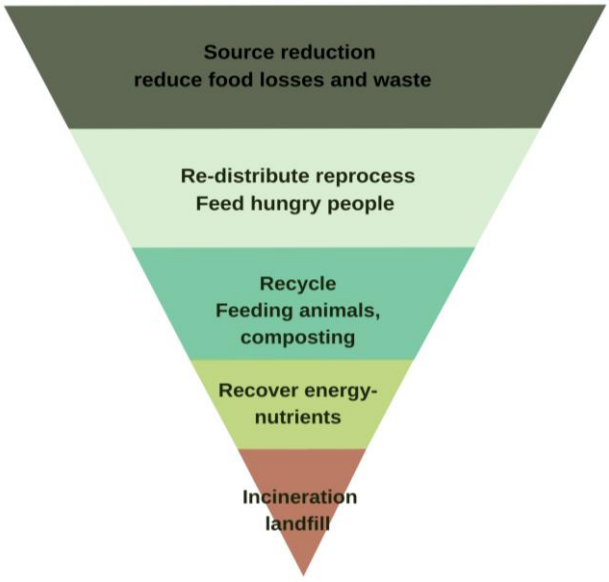


**Fig. 4:** Sustainable solutions for food safety and security (Retrieved from biorender)

**The Intersection of Food Safety, Food Security, and Public Health**

Food security and safety are deeply intertwined, helping us to remain healthy, well-nourished; food security means that all people at all times enjoy physical, economic, and social access to sufficient food for life. Food safety refers to availability of food that is hygienic. Thus the two work in tandem; they help safeguard us on both fronts-foodborne diseases and malnutrition-through safe but nourishing food.

When these elements are compromised, the consequences to public health can be very serious. A lack of safe or sufficient food weakens the immune system, increases people's vulnerability to disease, and, in extreme cases, causes starvation. The nexus between food security, food safety, and public health is the point at which the greatest impacts on our nutrition and overall well-being are experienced. These areas are interconnected and their success depends on collaboration to address shared challenges (Rizzo et al., 2021).

Public health efforts are about protecting and improving the health of communities, and they naturally overlap with food security and safety. For example, ensuring that everyone has enough to eat reduces illnesses related to hunger, such as nutrient deficiencies. Preventing contamination in our food supply supports a strong immune system and helps stop foodborne diseases. When food is safe and accessible, it prevents us from malnutrition and further lowers the incidence of illness spread. It is by understanding such relationships that we will be able to build a healthier and more resilient society. When people have access to food that is safe and plentiful, they will flourish. And when public health, food security, and food safety come together, we have a powerful foundation for reducing malnutrition, preventing disease, and improving quality of life for everyone (Figure 5).

**Innovative and Sustainable food Preservation Techniques**

This will involve the use of creative and sustainable food preservation methods that will increase food safety and quality while reducing environmental impact. Techniques that support sustainability objectives include non-thermal technologies that can efficiently inactivate microorganisms without compromising nutritional and sensory qualities, including pulsed light, cold plasma, high-pressure processing (HPP), ultraviolet (UV) radiation, and pulsed electric fields (PEFs). This initiative is supported by the promotion of environmentally friendly natural preservatives such as plant extracts, microbiological agents, and enzymes as alternatives to synthetic chemicals. Advanced packaging techniques including intelligent packaging, MAP, and biodegradable materials are also essential to cut down on plastic waste and increase shelf life. The research will base life cycle studies on those methods to find out how waste reduction, water usage cutbacks, energy consumption minimization, and subsequently the minimized emission of greenhouse gases can be achieved into the atmosphere. In addition, through this research, the potential of nanotechnology as well as PAW to even further enhance sustainability by inclusion in innovative approaches for a food industry will be established and explored (Lisboa et al., 2024).

Food security and safety depend on food preservation, which prolongs product shelf life while preserving sensory, safety, and nutritional attribute. Key tactics for preserving food availability include freezing, canning, refrigeration, and chemical preservatives (Sridhar et al., 2021). However, these processes raise environmental and health problems, such as greenhouse gas emissions, excessive energy consumption, and the risk of toxic chemical residues (García-Díez et al., 2021). As sustainability becomes more important, the food business must employ eco-friendly preservation procedures to decrease environmental effect and protect public health (Figure 6).


**Fig. 5:** The Intersection of Food Safety, Food Security, and Public Health (Retrieved from biorender)

**Production and Postharvest Technology for Safe Food**

A focus on produce safety, which is a broad category that includes fresh and processed culinary herbs, tree nuts, sprouts, and fruits and vegetables. All types of produce are generally seen as essential to a balanced diet, and during the past three decades, people have been encouraged to consume more fruits and vegetables. During this time, the United States has seen a sharp increase in the consumption of fresh fruits and vegetables. Options for post-harvest processing of vegetables range from low-tech, antiquated methods like fermentation and drying to high-tech methods like high-pressure processing. Nearly half of the world's produce is never eaten, even with the many methods for preserving it (Monteiro et al., 2021).

Waste is greater and nearer to the point of consumption (retail and final preparation) in developed countries, whereas in emerging economies, a lack of basic infrastructure and a cold chain pushes waste closer to production and processing. The role of fruits and vegetables in foodborne illness in the United States has become better understood due to a number of factors, including a rise in overall consumption, a move towards fresh fruits and vegetables rather than processed or cooked ones, and notable advancements in surveillance and detection techniques. About 55% of foodborne disease cases reported in the US each year in recent years have been related to FDA-inspected foods (apart from meat and poultry) (White et al., 2022).

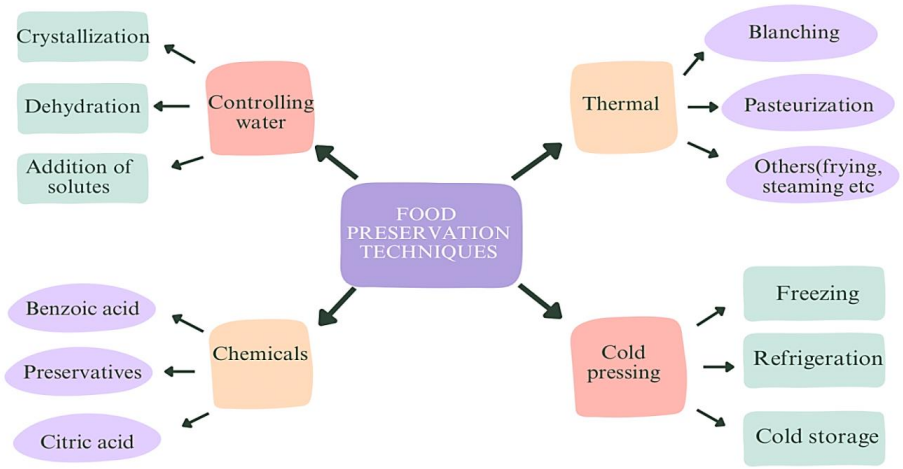


**Fig. 6.** Techniques of food preservation (Retrieved from biorender)

**Explore Community Initiatives and Policies Promoting Sustainability**

Research on how government policies impact sustainable food systems argues that food security must be balanced with environmental, economic, and social sustainability. Globalization, policy inconsistency, inequality in socioeconomic statuses, and climatic uncertainty are just some of the key challenges. Yet, breakthroughs like biotechnology, precision agriculture, and climate-smart practice that open avenues for increased sustainability and resilience reduce the challenge. The way forward involves supply chain bolstering, policy consistency, international cooperation, and education (Agarwala et al., 2022).

**Community efforts:** Community activities and policies play an important role in improving food sustainability and resolving food security concerns. At the neighborhood level, urban agricultural programs like community gardens, rooftop farming, and hydroponic systems enable communities to grow their own food and lessen their dependency on delivered products. Farm-to-table initiatives develop ties between local farms and institutions, increasing access to fresh, locally sourced food via farmers' markets and collaborations (Stein & Santini, 2022). Food waste reduction efforts include home and company composting programs, as well as food rescue projects that redistribute extra food to those in need. Educational campaigns on sustainable eating habits and community-supported agriculture (CSA) initiatives increase awareness and involvement, while seed libraries and water conservation courses enable individuals to adopt sustainable practices in their homes and gardens.

**Policy initiatives:** On the policy level, governments may bolster these efforts by promoting local agriculture and sustainable food systems. Tax breaks for small-scale farmers, farmland-protecting zoning rules, and infrastructural expenditures all help to boost local food production. Policies that encourage food waste reduction, such as required food donations and composting legislation, help to alleviate system inefficiencies (Patel et al., 2023). The integration of regenerative agricultural subsidies, sustainable procurement rules for public institutions, and climate-smart agriculture regulations ensures better alignment of food production with environmental goals. Food sustainability at both the local and

global levels may be attained by integrating these strategies with the international frameworks like UN Sustainable Development Goals (SDGs) and promoting public-private partnerships among communities and governments.

**Innovative Solutions for Sustainable Food Systems**

**Advancing Climate smart agriculture**

Climate change is one of the significant challenges to food security, with impacts on food supply and demand at a global level. This can be resolved through proper management techniques combined with efforts by developed and developing countries. The sharing of technology and financial resources through the implementation of modern food management techniques will allow countries to adapt to the effects of climate change and establish sustainable food systems (Raihan et al., 2024). Innovation, investment, and institutional support are critical for climate-smart agriculture. That is, with better knowledge about the benefits of crop insurance among farmers and if appropriate services become available to them, it will become much more significant to adopt climate-smart agricultural practices at a significantly faster pace. These methods have a great potential to enhance resilience and sustainability and are an essential connection between food security and climate change adaptation. The agricultural sector has to rapidly change with new technologies, investment in the public and private sectors, and ensuring that governments are behind climate-smart agriculture. There should be proper institutional frameworks, policies, and investments in such ways so that climate-smart agriculture can be well implemented and monitored to finally ensure food security (Babele et al., 2022).

**Whole Genome Sequencing (WGS)**

WGS is a cutting-edge technology used to identify and track food borne pathogens, uncover food fraud, and monitor the emergence of antimicrobial resistance (AMR) in the food system. Its applications include tracing specific pathogens, identifying sources of contamination or fraud as well as mapping hotspots for food borne diseases. This technology widely used in at least 10 high-income countries. Its growing use in low- and middle-income countries (LMICs) supported by initiatives like the U.S. CDC's Pulse Net International and FAO collaborations (Davedow et al., 2022). Example includes in Kenya (2016), WGS identified high-risk foods and geographic hotspots for pathogens and During South Africa's Listeria outbreak, WGS pinpointed the source, enabling targeted recalls.

**Challenges**:

- High costs of bioinformatics for data analysis.
- Limited accessibility in resource-constrained settings.

**Blockchain Technology**

Blockchain enhances traceability and transparency by maintaining verified and linked records accessible to all parties in the supply chain. When combined with other technologies like RFID or IoT, it revolutionizes how perishables are tracked and managed. Its application includes to ensure traceability of food products, documents production processes and tracks perishables' conditions and reduces food borne illness outbreaks. It reduces time for trace back, limiting waste and resource loss (Patel et al., 2023). It facilitates governance and transparency in supply chains. Examples includes Oxfam's program in Cambodia: Organic rice producers used block chain for better traceability and immediate payments via mobile phones.

**Challenges**:

- High start-up costs and issues with liability and standardization.
- Limited Smartphone and internet access in LMICs.

**Future Potential**

Both WGS and blockchain are at the forefront of modern food safety management, supported by investments from public and private sectors. These technologies offer promise for big data applications in food safety, linking diverse data sources to better manage risks (Unnevehr, 2022). They are already being applied to commodities like fresh produce, pork, turkey, and seafood and demonstrate potential to empower small-scale farmers through mobile-integrated solutions.

**Conclusion**

Food security and safety have become an issue for public health because that ensures the availability of quality wholesome food to all at the same time protects this food from infection. All these, however, is becoming very difficult due to factors like climate change, scarce resources, and rampant urbanization. New and innovative techniques such as whole genome sequencing, blockchain technology, and climate smart farming are devised to counter these issues. These innovations enhance our capacity to control risks and trace the origin of food while strengthening our defenses against potential threats. These flexible solutions promote healthier and more sustainable communities while protecting food systems. Sustainable preservation methods and community-driven projects to enhance food access and minimize waste are also equally important. Policies supporting local agriculture, prioritizing food waste reduction, and education improvement will greatly support long-term community sustainability. Governments, scholars, and other stakeholders will have to collaborate and harmonize international initiatives with regional ones to achieve these goals. Governments, researchers, among others, have to partner together to merge their combined global efforts with local efforts in action. Combining these approaches would enable us to design resilient food systems that provide and deliver on safety, nutritional quality, and equity in the environmental health of those people and the earth. Achieving this set of interlocking goals will be a tremendous step toward a healthy future for all.

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