Bio Vet Innovator Magazine
Volume 2 (Issue 3) MARCH 2025
OPEN ACCESS
Popular Article

Public Health Implications of Microbial Food Safety And Food Borne Disease In Developing Countries

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DOI: https://doi.org/10.5281/zenodo.15089674

Received: March 05, 2025
Published: March 10, 2025

Introduction:

Food is one of the most important routes of transmission for the infectious diseases. Microbial safety and quality of food is a global health concern due to the emergence and re-emergence of foodborne pathogens worldwide recently. It is one of the causes of morbidity and mortality in developed and developing countries. Foodborne disease can be defined as 'any disease usually either infectious or toxic in nature, caused by agents that enter the body through ingestion of food.' There are several potential causes of foodborne illness where foodborne disease could be due to microbial pathogens, naturally produced toxins, or other chemicals that have entered the food supply chain. Microbial pathogens are disease-causing bacteria, viruses, fungi, and protozoans. Among these, the most prevalent cause of foodborne illness is bacteria (66%), followed by chemicals (26%), viruses (4%), and protozoans (4%). Globally, more than 250 sources of foodborne diseases have been identified. The rise in foodborne infectious disease has led to the implementation of various food quality standards in different countries.

According to Delia Grace (Epidemiologist and Veterinarian), there is famine regarding foodborne diseases in developing countries. Consumption of food contaminated with foodborne pathogens and microbial by-products such as toxins could result in serious illnesses and economic losses. Microbial pathogens and toxins in food can cause foodborne diseases, posing global health and economic risks, particularly for those with compromised immune systems. Individuals with weak immune systems, children, elderly individuals, and newborns are the most commonly affected. Currently, foodborne illnesses—among the more than 13 zoonoses are linked to more than 2 billion illnesses globally—cause more than 2.3 million death per year in developing countries.

It is therefore important that public health is taken into serious considerations in developing countries. In developing countries, governments, policymakers, scientists, and the general public must work together to raise awareness and stop the spread of foodborne illnesses.

The Global Burden of Foodborne Illnesses:

Foodborne illnesses pose a significant global public health challenge, with millions of people falling ill each year due to contaminated food. The global burden of infectious diarrhea involves 3-5 billion cases and nearly 1.5 million deaths annually, primarily in young children, due to diarrheal disease caused by contaminated food and water. According to a recent World Health Organization (WHO) report, over 100 million people are affected and approximately 420,000 deaths are reported each year in India.

With 25% of the world's population living in the WHO South East Asia Region, diarrheal illnesses remain one of the top three causes of disability-adjusted life years (DALYs) losses. One-third of all deaths worldwide from diarrhea in children under five years are attributable to the WHO South East Asia Region.

Source of The Foodborne Disease:

The public health relevance of pathogenic organisms disseminated by contaminated foods includes bacteria, viruses, protozoa, trematodes, cestodes, and nematodes. In terms of taste, smell, or appearance, contaminated food would be indistinguishable from non-hazardous options. The pathogens responsible for food poisoning outbreaks in India included various strains of *Staphylococcus aureus*, *Vibrio spp.*, *Salmonella spp., Escherichia coli*, and *Yersinia enterocolitica*. *Salmonella* is the most common cause of food poisoning, but *Listeria monocytogenes*, which can flourish in the refrigerator, can also pose a risk to items that are ready to consume. *Norovirus* and *Hepatitis E virus* are two emerging viruses that are also considered major contributors to foodborne disease.

Food Borne Diseases Are Classified Into:

1. **Food borne infections:** Caused when a person eats food containing harmful microorganisms, which invade and multiply in the intestinal tract or other tissues. Ex. *Salmonella, Campylobacter, Vibrio,* and *Yersinia enterocolitica.*
2. **Food borne intoxications:** Ingestion of foods containing either poisonous chemicals or toxins produced by microorganisms in the food. Ex. *Clostridium botulinum, Staphylococcus aureus,* and *Clostridium perfringens;* chemicals such as sanitizing products; metals; seafood toxins such as ciguatera and scombroid.

The pathogenic organisms transmitted through contaminated foods are bacteria, viruses, protozoa and helminths. Some important microbial pathogens responsible for foodborne illnesses along with their sources are mentioned in Table 1.

Pathogens	Disease caused	Source
Salmonella	Diarrhea, fever	Contaminated poultry, eggs, dairy
Escherichia coli	Hemorrhagic colitis, kidney failure	Contaminated meat, raw vegetables
Campylobacter	Diarrheal diseases	Undercooked meat, unpasteurized milk
Vibrio cholerae	Cholera, dehydration	Contaminated water, seafood
Listeria monocytogenes	Meningitis, stillbirth	Processed foods, diary, raw vegetables
Norovirus	Vomiting, diarrhea	Contaminated seafood, raw produce

Over the years, safety and quality of food produced for human consumption in developing countries continue to increase because of foodborne disease outbreaks attributed to unsafe raw food, temperature, poor storage infrastructures, inadequate cooking, poor personal hygiene, improper handling methods, and cross- contamination

of cooked food with uncooked raw food. Foodborne sickness is one of the most common emerging and re-emerging diseases that have been identified in recent decades worldwide. These include *Yersiniosis, campylobacteriosis,* enterohaemorrhagic *E. coli* infections, *cyclosporidium,* and *cryptosporidiosis*. These microbes have animal reservoirs and are associated with the consumption of foods of animal origin, contact with contaminated soil, and infected animals.

Chemical contamination of food may result from various sources. Industrial or agricultural practices such as the use of pesticides and fertilizers lead to the entry of heavy metals such as cadmium, lead, and mercury into the food chain. Chemical food poisoning can also occur through adulteration of food by adding prohibited substances to partly or wholly substitute healthy ingredients or to artificially create the impression of freshness in stale food. Adulterants may be in solid form, chemicals or liquids and made up of coloring substances.

Mycotoxins are a group of naturally occurring chemicals produced by certain molds and fungi. They can grow on a variety of different crops and foodstuffs, including cereals, nuts, spices, and dried fruits. Mycotoxins are produced by several fungi in foodstuffs, and these feed during production, storage, and transportation, often under warm and humid conditions. Mycotoxins such as aflatoxins, ochratoxin A, fumonisins, trichothecenes, ergot alkaloids, and zearalenone are of public health importance. In India, moldy maize, sorghum, and wheat flour are associated with outbreaks of mycotoxicosis.

➢ There are many other factors influencing occurrence of foodborne diseases in developing countries, which when properly addressed can lead to reduction in occurrence of these diseases.

- Climate change has been identified as one of the most complex global issues affecting food safety. Climate change is exacerbating microbial food safety risks by altering environmental conditions that favor the spread of pathogens. Rising temperatures, extreme weather events, and water scarcity contribute to food and water contamination. Increased flooding can spread bacteria and parasites, while droughts lead to poor hygiene and unsafe food handling practices.
- Concerns over food safety have also been raised by the globalization of the food supply, particularly in light of the disparity between the norms of importing and exporting nations. Because there is little possibility that contaminated goods would be recalled once they cross international borders, it is challenging to ensure compliance, endangering people's lives by causing them to inadvertently consume possibly contaminated commodities.
- Antimicrobial-resistant bacteria have emerged as a result of the overuse of antibiotics in food production, making infections more difficult to cure. Prolonged hospital stays and serious problems have been associated with resistant strains of *Salmonella,* and *E. Coli.* The emergence of AMR poses a challenge to contemporary medicine by decreasing the efficacy of antibiotics, raising healthcare expenses, and raising the death rate.

A Public Health Priority – From Farm To Fork:

Governments should make food safety a public health priority, as they play a pivotal role in developing evidence-based policies and risk-based, flexible regulatory frameworks and establishing and implementing effective food safety systems. Consumers and food handlers must be aware of the WHO five keys to safer food at home and know how to handle food safely. Various national authorities have responsibility for food safety, which necessitates a

multisectoral, one health approach to be addressed at every stage of the food chain.

FIVE KEYS TO SAFER FOOD:

1. Keep Clean
2. Separate raw and cooked food
3. Cook thoroughly
4. Keep food at safe temperatures
5. Use safe water and raw materials

In order to reduce the severity of food-borne illness in India, preventative measures and interventions have been put in place. The Food Safety and Standards Authority of India (FSSAI) has instituted legal safeguards, such as the Food Safety and Standards Act (Food Safety and Standards Authority of India, 2018), to guarantee that every food produced in India is safe and prepared properly. Food safety training and surveillance systems have also been implemented to inform the public and enhance current methods of food handling.

In conclusion:

Economic and public health implications of foodborne diseases in developing countries cannot be overestimated. Therefore, collaborative effort between governments of developing countries, policymakers, researchers, and general public is imperative to reduce incidence of foodborne diseases. Use of rapid methods for detection of foodborne pathogens is required in developing countries. Human capacity development in state-of-art technologies and foodborne pathogen detection methods among researchers in developing countries in collaboration with researchers in developed countries is also encouraged for the prevention of transmission and awareness of foodborne diseases.

Citation: Shipra, Ranveer Godara, Akshika Agrawal, Vaishali. (2025). Public Health Implications of Microbial Food Safety And Food Borne Disease In Developing Countries. In Bio vet innovator magazine (Vol. 2, Issue 3, pp. 5–8). Bio vet innovator magazine. https://doi.org/10.5281/zenodo.15089674