Challenges in food safety

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Outline

A.) Food safety
B.) Challenges in food safety
C.) Sources and solution
D.) Role of research and academe in food safety
E.) Role of government in food safety
F.) Take away message(s)
A. Food safety
The handling, preparing and storage of food products the best way possible to reduce the risk of contracting foodborne illnesses.

A joint effort starting from the handler, preparer, and consumer to ensure the implementation of practices for food safety.
Food safety, nutrition and food security are inextricably linked (WHO, 2022).

- An estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food.
- Children under 5 years of age carry 40% of the foodborne disease burden.
- US$ 110 billion is lost each year in productivity and medical expenses resulting from unsafe food in low- and middle-income countries.
- Foodborne diseases impede socioeconomic development by straining health care systems and harming national economies, tourism and trade.
DRIVING FORCES SHAPING FUTURE FOOD SYSTEMS

SEVERAL EXTERNAL FACTORS ARE DRIVING STRUCTURAL CHANGES IN THE FOOD SYSTEM, PRESENTING OPPORTUNITIES & CHALLENGES FOR FOOD SAFETY, AS WELL AS OTHER INTER-RELATED ASPECTS, SUCH AS SUSTAINABILITY, AFFORABILITY, NUTRITION & INCLUSIVENESS.

2/3 will live in cities by 2050
2 billion in slums
Africa & Asia will account for 90% of the increase
Increase of susceptible consumers

ICT, Automation, Biology & Artificial Intelligence (AI) will affect food system productivity, profits and jobs in multiple ways.
Enabler for Predicting Food Safety Risks, Improved Risk Management & Food System stakeholder participation

Cities & Local actors are key to developing innovative solutions.
Fuzzy Food Networks
"local is the new global"

Food SafeR future-oriented Food Safety Hazard Management based on multi-criteria risk assessment for safer food:
Co-benefits: consumer health and wellbeing, climate (mitigation and adaptation), environmental sustainability & circularity, dietary shift, sustainable healthy nutrition, food poverty reduction & empowerment of communities, and thriving businesses.

Food Sectors generates value-added growth & jobs, but socioeconomic inequality persists.

Growing demand for convenience, animal protein an food away from home.
6 of the top 11 global disease factors are linked to diet

Post-Production food system generates 6% of global GHG emissions.
5 SUSI SA HIGIT NA LIGTAS (WALANG PANGANIB) NA PAGKAIN

**PANATILING MALINIS**

**BAKIT?**
- Make sure to wash your hands regularly and thoroughly.
- Use clean utensils and cookware.
- Cover food and store it properly.
- Keep the cooking area clean.

**HIWALAY ANG HILAW SA LUTO**

**BAKIT?**
- Boil water for 1 minute to kill parasites.
- Use boiled or bottled water for cooking.
- Do not use water from natural springs or streams.
- Wash your hands with soap and water before and after handling food.

**LUTUING MABUTI**

**BAKIT?**
- Cook meat and poultry thoroughly.
- Use a meat thermometer to check internal temperature.
- Avoid cross-contamination between raw and cooked food.
- Store meat and poultry at the bottom of the refrigerator.

**ITAGO NG PAGKAIN SA TAMANG TEMPERATURA**

**BAKIT?**
- Store food at the correct temperature to prevent bacterial growth.
- Use a food thermometer to check internal temperature.
- Avoid leaving food out at room temperature.
- Cool food quickly after cooking.

**SUMAMIT NG LIGTAS/MALINIS NA TUNGO AT SATANAW PAGKAIN**

**BAKIT?**
- Use clean plates and utensils.
- Cover food before serving.
- Use a clean serving utensil.
- Wash your hands before and after handling food.

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**Five keys to safer food**

**Keep clean**
- Wash your hands before handling food and after using the toilet.
- Wash your hands after handling raw meat or poultry.
- Avoid cross-contamination between raw and cooked food.

**Separate raw and cooked**
- Use separate cutting boards and utensils for raw and cooked food.
- Chill or freeze cooked food at home.
- Eat immediately after cooking.

**Cook thoroughly**
- Cook meat and poultry to the correct internal temperature.
- Use a meat thermometer to check internal temperature.
- Avoid leaving food out at room temperature.

**Keep food at safe temperatures**
- Store food at the correct temperature to prevent bacterial growth.
- Use a food thermometer to check internal temperature.
- Avoid leaving food out at room temperature.

**Use safe water and raw materials**
- Use clean water and wash your hands.
- Use fresh, clean, and safe raw materials.
- Wash your hands after handling raw meat or poultry.

**Knowledge = Prevention**
World Food Safety Day

- Yearly event that started 2019 and celebrated every June 7

- WHO uses this event to promote food safety to the public and reduce the number of illnesses that is caused by foodborne illnesses globally
RA 10611 or the Food Safety Act of 2013

An Act To Strengthen The Food Safety Regulatory System In the Country To Protect Consumer Health And Facilitate Market Access Of Local Foods And Food Products, And For Other Purposes.
B. Challenges in food safety
Aquatic and Agricultural Resources

- Fish
- Shellfish
- Seaweeds
- Crops
- Produce
Consumption of contaminated food → Outbreaks due to pathogenic microorganisms

Food and water-borne diarrhea

(FAO & WHO)
Challenges in Food Safety

10 dead in diarrhea outbreak in S. Philippines

Source: Xinhua Published: 2018/2/20 10:52:31

Salmonella summons PHL farm sector’s strength

By Jasper Y. Arcolas - August 9, 2017
Contaminants

- Something that makes a place or a substance (such as water, air, or food) no longer suitable for use or for consumption.
- **Microbiological contamination** refers to the non-intended or accidental introduction of infectious material or pathogens.
Pathogens

- an organism causing disease to its host
  - the severity of the disease symptoms referred to as “virulence”
- comprised of viruses and bacteria as well as unicellular and multicellular eukaryotes.
Sources of microbial contamination in agriculture and aquaculture

Pre-harvest → Water Quality

During harvest

Post-harvest
Hazards vs. Risk

HAZARD
Any agent in (biological, chemical, or physical) or condition of food having the potential to cause adverse health effects

RISK
A function of the probability of an adverse effect and the severity of that effect consequential to a hazard in food

Definitions according to Codex Alimentarius Commission
Commodities of Concern

Fish and other Aquatic Resources         Fresh Produce and other Crops

➢ Fish and shellfish, being live organisms, can become hosts and vector to parasites and pathogens
➢ Uncooked fresh produce can harbor pathogens

➢ Contamination occurs during pre-harvest, post harvest, processing, distribution, and preparation in food service or at home
➢ Improper handling and storage results to spoilage and contamination after harvest
Pathogen Sources

- Animal and Human Wastes
- Cross contamination
Common Pathogens

- Bacteria
- Protozoa
- Viruses
- Algae
- Fungi
Common Food Pathogens

*Escherichia coli*

- One of the most common causative agents of foodborne outbreaks around the world

Gram stain slide showing *E. coli*
Escherichia coli

- Most *E. coli* strains do not cause severe illness, but some strains, such as the O157:H7 which causes severe complications (bloody diarrhea, kidney failure, death)
Mode of transmission

- Lower intestine of warm-blooded organisms
- Fecal contamination of vegetables
- Undercooked meat
- Serious food poisoning

*Escherichia coli*
Common Food Pathogens

*Salmonella*

- 550 million people fall ill each year due to *Salmonella*
- Causes:
  - Salmonellosis
  - Enteric fever

*World Health Organization*
Mode of transmission

- Livestocks
- Salmonellosis
- Cross-contamination
- Food handling

Salmonella
**Vibrio spp.**

- are abundant in aquatic environments, both in fresh and marine sources.
- These bacteria were also observed on the skin, gills, and the intestinal tracts of fish or shellfish.

*Gram stain slide showing* *Vibrio cholerae*

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**Common Food Pathogens**
Vibrio spp.

- Can contaminate fish and fish products during improper handling, long-time transport, evisceration, and also cross-contamination from raw materials.
Foodborne Intoxications

Caused by consumption of food contaminated with metabolites excreted by microorganisms
Foodborne Intoxications

Harmful Algal Bloom (HAB)

➢ Red tides refer to toxic blooms of microscopic algae that occur worldwide

➢ Toxins can target multiple organ systems, including the nervous system, the liver, the skin, and the respiratory tract.
Antimicrobial Resistance

- Antibiotics have been used in different fields, in agriculture it is used on plants and animals to combat diseases.
- However, long term use promotes antimicrobial resistance (AMR) of bacteria in the environment.
- As antibiotics are completely absorbed, they settle in excrement and are used as fertilizer in the soil.
Figure 1: Transmission dynamics of antibiotic-resistant genes and bacteria among humans, livestock, environment, and fresh produce (Vital and Rivera, 2023).
Chemicals

- Naturally occurring toxins
- Persistent organic pollutants (POPs)
- Heavy metals
- Other chemical hazards
Food safety during pandemic

- Meal kits and delivery
- Handling packaged food
- Handling and cleaning
- Food donations
- Spread of pathogens and AMR
MOST VULNERABLE TO FOODBORNE ILLNESSES

Elders

Children

Pregnant Women

People with weak Immune System
Food safety, security and sustainability

Economy
- Net income
- Labour productivity
- Water efficiency
- Nitrogen-use efficiency
- Phosphorus-use efficiency

Society
- Women empowerment
- Eradicate child labour
- Worker health and safety

Environment
- Reduce pesticides
- Reduce herbicides
- Reduce greenhouse gas emissions

Food Safety
C. Sources and solutions
GOOD AGRICULTURAL PRACTICES ARE MEASURES TO PREVENT OR REDUCE THE RISK OF HAZARDS OCCURRING DURING PRODUCTION, HARVEST, POSTHARVEST HANDLING, AND ENSURING ANIMAL AND HUMAN HEALTH AND WELFARE.
SOURCES OF CONTAMINATION IN FARMS

- SOIL
- WATER
- ANIMAL WASTE
- WORKERS
- ANIMALS
- SEWERAGE
Pre-Harvest Practices to Reduce Microbial Contamination

- Assess if the fish pond is free from chemical or biological hazards before production.
- Avoid entrance of farm animals to the pond sites at least 3 months before or during production.
- Ensure that good water source is available and no overcrowding of fish is permitted.
- Use only sterile fry as starting materials.
Pre-Harvest Practices to Reduce Microbial Contamination

- If outbreaks occur, report immediately to government agencies. Limit cross contamination to other ponds.
- If red tide is observed, notify BFAR and avoid catching shellfish.
Pre-Harvest Practices to Reduce Microbial Contamination

- Ensure human sewage is treated before releasing to aquatic resources.
- If water testing is available, tests should be done to identify possible contamination in water sources.
- Provide a safe alternative water source.
Harvest Practices to Reduce Microbial Contamination

- Equipment used should be washed before and after use.
- Harvest containers are checked and cleaned before use.
- After packing, containers should not be placed in direct contact with soil and water.
- Farm animals are banned where produce is handled, packed, and stored.
Post-Harvest Practices to Reduce Microbial Contamination

- Packed container are not placed in direct contact with soil.
- Transport vehicles are checked before use.
- Produce are stored and transported separate from goods that may potentially cause contamination.
WHO aims to strengthen national food control systems to facilitate global prevention, detection and response to public health threats associated with unsafe food.

- Assess the safety of new technologies used in food production, such as genetic modification, cultivated food products and nanotechnology

- Help implement adequate infrastructure to manage food safety risks and respond to food safety emergencies through the International Food Safety Authorities Network

- Promote safe food handling through systematic disease prevention and awareness programmes, through the WHO Five keys to safer food message and training materials
WHO response

- Advocate for food safety as an important component of health security and for integrating food safety into national policies and programmes in line with the International Health Regulations.

- Monitor regularly the global burden of foodborne and zoonotic diseases at national, regional and international levels, and supporting countries to estimate the national burden of foodborne diseases.

- Update the WHO Global Strategy for Food Safety (2022-2030) to support Member States to strengthen their national food control systems and reduce the burden of foodborne diseases.

WHO works closely with Food and Agriculture Organization (FAO), the World Organization for Animal Health (OIE), The UN Environment Programme (UNEP) and other international organizations to ensure food safety along the entire food chain from production to consumption.
D. Role of research and academe in food safety
Food Safety in Microbiology
Techniques in Microbiology

"Pouring a Plate"

Sterilised molten agar is poured in and left to set.

Neck of agar bottle is passed through flame

Petri dish lid is opened as little as possible, angled and kept over the base.

Each Petri dish holds about 20 ml, so 200ml will do for 10.

INOCULATION

If using a broth culture or other liquid source

Stage 1
Heat wire loop to red hot in a non-luminous Bunsen flame ..., then leave loop to cool

Stage 2
Loosen lid carefully, then remove lid and pass mouth of bottle through flame
Do not put lid down on bench!
Insert sterilised loop and pick up a drop of liquid

Universal screw-capped bottles are held at an angle

Pass mouth of bottle through flame again before applying lid
Drop of liquid may be transferred to agar in Petri dish or broth in a universal bottle

Lid of Petri dish is opened as little as possible and liquid is spread over the agar surface

Mouth of second bottle is flamed

Drop of liquid is transferred

Used wire loop must be heated again to red hot - in order to kill the remaining bacteria

Bottle is flamed again and heated
Molecular Techniques

- Conventional PCR
- Nested PCR
- Multiplex PCR
- Reverse transcriptase (RT) PCR
- Real Time PCR (q PCR)
- Serial analysis of gene expression (SAGE)
- DNA barcoding

- Northern Blotting
- In-situ Hybridization
- FISH

- Microarray
- Macroarray

- RCA
- LAMP
- NASBA
E. Role of government in food safety
Effective regulations are needed to address food safety issues

Food safety is a shared responsibility of government agencies
PHILIPPINE NATIONAL STANDARD

Primary and Postharvest Food and Feed — Product Standard — Microbiological Criteria

Department of Agriculture (DA)
Bureau of Agriculture and Fisheries Standards (BAFS)

Technical Working Group (TWG) for the Development of the Philippine National Standards (PNS) on Microbiological Criteria for Primary and Postharvest Food and Feed — Product Standard

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Establishment and Application of Microbiological Criteria related to Food
F. Take away message(s)
Summary

There are many opportunities for food contamination to take place.

Contaminated food can cause long-term health problems.

Food contamination also affects the economy and society as a whole.

(WHO, 2016)
Summary

Some harmful bacteria are becoming resistant to drug treatments (WHO, 2016)

Consumers must be well informed on food safety practices

Everybody has a role to play in keeping food safe
New challenges to food safety will continue to emerge, largely because of:

- Changes in our food production and supply, including more imported foods.
- Changes in the environment leading to food contamination.
- New and emerging bacteria, toxins, and antimicrobial resistance.
- Changes in consumer preferences and habits.
- Changes in the tests that diagnose foodborne illness.
Take away messages

Food Safety Matters
It is everyone's responsibility

Safety + Sustainability
FRESHEST THANKS
Challenges in food safety

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