

Food Safety

10 Dec 2015, minato-nakazawa@umin.net

- Frumkin H [Ed.] (2010) Environmental Health: From Global to Local, 2nd Ed. Chapter 18 "Food Safety" pp.635-688.
- KEY CONCEPTS
 - Foodborne illness can threaten public health
 - Three classes of hazard (biological, chemical, physical) can cause foodborne illness
 - Especially susceptible people to foodborne illness
 - Potentially hazardous foods escaping from time-temperature safety control
 - Interventions including HACCP
 - The "food environment" refers to the availability in schools, communities, and other settings, of both nutritious foods and unhealthy foods; complementing traditional food safety approaches
- Other reference web pages
 - [WHO/Food safety] <http://www.who.int/foodsafety/en/>
 - [Online course] http://www.sp-lab.net/fao/MRA/mra_en/index.html
 - <http://extension.psu.edu/food/safety/courses>
 - [USMEF HACCP video] https://www.youtube.com/watch?v=50e_lc2rPK4

The extent of foodborne illness

- Foodborne illness: the sickness which people experience after consuming food and beverages contaminated with pathogenic (disease-causing) microorganisms, chemicals, or physical agents
- Common symptoms: nausea, vomiting, diarrhea, abdominal pain, headache, fever, dehydration and those combinations
- Common and mild, so underreported
- Annual burden in USA: 10 - 80 million cases
 - The wide range of the estimate comes from underreporting and the fact that the same pathogen can transmit via water
 - CDC estimate in 1999: 76 million cases, 325000 hospitalization, 5000 deaths
- Natural / organic foods are not always safe
 - less human origin chemical hazards
 - equal biological hazards

The 3 major reasons

- Known pathogens are found in a growing number of foods
 - Salmonella bacteria: Commonly found in raw poultry and eggs / caused foodborne illness for many years. Recently linked to large outbreaks and "product recalls" of peanut butter and raw produce. More than 1440 cases caused foodborne outbreak (FDA and CDC)
- New pathogens are being discovered
 - Listeria monocytogenes in soft cheeses
 - Cyclospora cayetanensis in fresh fruits and vegetables
- Number of immunocompromised people is growing
 - Healthy adults remain asymptomatic or mild
 - Infants, young children, elderly, pregnant women, nursing mothers, impaired immune function due to HIV, cancer, diabetes may have heavy symptoms

Common sources of food contamination

- Air
- Water
- Soil
- Food handlers
- Packaging materials
- Animals, rodents, and insects
- Food contact surfaces
- Ingredients

Biological, Chemical and Physical Hazards

- Biological hazards
 - microscopic organisms: bacteria, viruses, parasites
 - invisible challenges to food safety
 - Controlling biological hazards is a primary goal of every food safety program
- Chemical hazards
 - harmful substances
 - naturally occurring like food allergens, toxins associated with molds, plants (incl. fungi), fish, shellfish
 - human origin like pesticides, cleaning agents, metals, PCB
- Physical hazards
 - foreign objects like stones, bone fragments from animals, pieces of glass, staples, jewelry
 - originated from poor handling, processing

PHF/TCS foods and potentially contaminating bacterias

- Potentially hazardous foods and time/temperature control for safety foods
 - Foods of animal origin that are raw or heat-treated
 - Foods of plant origin that are heat-treated or consist of raw seed sprouts
 - Cut melons (for example, cantaloupe)
 - Garlic and oil mixtures that are not modified in a way to inhibit the growth of pathogenic microorganisms
 - Cut tomatoes
- Spore-forming bacteria
 - Clostridium perfringens: anaerobic
- Non-spore-forming bacteria: Shiga-toxin producing E. coli O157, Listeria Monocytogens, Salmonella, Staphylococcus aureus
- Viruses: HAV, Noro (increasing in Japan, rapid diagnostic test become available in insurance-covered since 2012)
- Parasites: Anisakis, Cyclospora cayetanensis

Investigation of foodborne disease outbreaks

- Purpose
 - Determine the cause of outbreak
 - Detect all cases, the foods and the beverages
 - Control the outbreak
 - Document foodborne disease occurrence
 - Correct poor handling
 - Revise HACCP plan
 - Foster public confidence in the food safety
- 9 steps (IAFP, 2007)
 - Obtain a description of food items and secure any leftover food items
 - Gather basic data
 - Formulate an initial hypothesis and case definition
 - Collect clinical specimens for testing
 - Develop a questionnaire
 - Analyze the questionnaires
 - Conduct an environmental investigation
 - Implement control measures
 - Summarize the investigation

Foodborne illness caused by chemicals

- Biomagnification
- Food allergens
- Ciguatoxins
- Scombrototoxin
- Mercury
- Polychlorinated biphenyls
- Bisphenol A
- Pesticides

Prevention

- Avoid risk factors listed below
 - improper holding temperatures
 - poor personal hygiene
 - improper cooking temperatures
 - foods from unsafe sources
 - contaminated equipment and cross-contamination
- HACCP (Hazard Analysis and Critical Control Point) approach is a central paradigm of food safety
 - The concept has been developed by NASA in 1971 to avoid foodborne illness in the space
 - Hazard analysis / Determine CCP / Establish Critical Limit / Establish monitoring system / Establish corrective action / Verify that the HACCP system is working effectively / Establish effective record keeping
- Food safety agencies and initiatives in USA
 - USDA (cf. HACCP advertisement for exporting meat), FDA (Good Agricultural Practices, Good Manufacturing Practices, 2005 Food Code), CDC, EPA
 - PulseNet, Fight BAC! Campaign, Consumer Advisories, Food Irradiation
- Emerging threats: Mad cow disease, bioterrorism, industrial production of food
- WHO 5 keys: http://www.who.int/foodsafety/areas_work/food-hygiene/5keys/en/