



Case Study: Pathogens and spices

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Outline

- Background
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Background

PHO's mandate is to provide scientific and technical advice and support to the health care system and government of Ontario

- Case studies: to share the diverse environmental health issues we have encountered and encourage dialogue in these areas.
 - Pathogens and spices



https://www.publichealthontario.ca/en/eRepository/Case_Study_%20Pathogens_Spices_2016.pdf

Public health unit request on pathogens in spices

1. What are the microbial qualities of spice/dried herbs products at point-of-sale?
2. Have low-moisture foods such as spices been associated with outbreaks of foodborne illnesses? What are the pathogens associated with these outbreaks?
3. How can microorganisms survive in low-moisture foods, and what are the contributing factors for contamination of low-moisture foods (specifically spices and dried herbs)?

Microbial qualities of spice/dried herbs

- A number of pathogens, including *Salmonella* spp., *S. aureus*, *E. coli*, *C. perfringens*, *Cronobacter* spp., *Shigella*, and *Bacillus* spp., have been identified in spices and dried herbs at point-of-sale.
- A 2014 Systematic review by Food and Agriculture Organization of the United Nations (2014)
 - Identified: 77 studies investigating the prevalence and/or concentration of microbial hazards in spices.
 - Concluded: many spices can be contaminated with various microbial hazards.

Pathogen detection in spices

Jurisdiction/Organiz ation	Time period	Number of recalls/ alerts	Pathogen detected
Canada/CFIA	2014 - 2015	14	Salmonella (14/14)
US /FDA	1970-2003	21	Salmonella (20/21) E. coli (1/21)
Europe/ European Commission	2008-2011	22	Salmonella (21/22) E. coli (1/22)

- Recall products in Canada included: paprika powder, spice products, white pepper powder, black peppercorn, carob powder, rosemary leaves, dried oregano leaves, garlic powder, kalonji, and chicken broth powder.

Foodborne illnesses outbreaks associated with spices and dried herbs

- Foodborne illnesses and outbreaks are often associated with spices and dried herbs that are added after food has undergone a kill step:
 - Canada 1974: Salmonellosis outbreak, 17 cases, black pepper.
 - Germany 1993: Salmonellosis outbreak, 1,000 cases, paprika added to potato chips.
 - US 2007: Salmonellosis outbreak, 69 cases, broccoli powder in spice mix used in veggie booty (a children's snack).
 - US 2009: Salmonellosis outbreak, 272 cases, black and red pepper added to ready-to-eat salami.

Microbial survival in low-moisture food

- Some microorganisms can survive in LMFs for a prolonged period of time.
- Survival of microorganisms in LMF depends on their ability to adapt to high osmotic potentials or dry conditions.
- Survival mechanism(s) for pathogens in LMF is not fully understood.
 - Exposure of *S. Enteritidis* to low a_w results in morphological changes of formation of filaments and development of elongated cells.
 - *Salmonella* spp are also capable of forming biofilms in low-moisture environments.

Microbial characteristics in a low moisture environment

Pathogen	Aerobic/Anaerobic	Survival in low-moisture foods
Bacillus cereus	Facultative anaerobe	Spores can survive for months or years in dry environment.
Campylobacter species	Microaerophilic	Does not survive in dry environment.
Clostridium botulinum	Anaerobe	Spores survive in dusty and dry environment.
Clostridium perfringens	Anaerobe	Spores can survive in dry environment.
Cronobacter species	Facultative anaerobe	Can survive in dry foods (evidence of survival of bacteria in powdered infant formula for up to two years).
Escherichia coli 0157:H7	Facultative anaerobe	Can survive in dry foods (e.g., dry fermented meats).
Listeria monocytogenes	Facultative anaerobe	Can survive in dry foods (e.g., dry fermented meats and peanut butter).
Salmonella	Facultative anaerobe	Can survive for weeks, months or years in low-moisture foods (up to a_w 0.30).
Staphylococcus aureus	Facultative anaerobe	Can survive for months in dry foods.

Contributing factors for microbial contamination in LMFs

- Poor sanitation
- Cross contamination
- Improper maintenance
- Poor equipment and facility design
- Lack of proper HACCP system and Good Manufacturing Plan (GMP)

Summary

- Spices and dried herbs available at point-of-sale can be contaminated with pathogens.
- Pathogens such as *Salmonella* spp can survive in low-moisture foods for weeks, months and even years.
- Spices or dried herbs contaminated with foodborne pathogens can contaminate ready-to-eat foods, which have resulted in human illness and outbreaks.
- Control measures can be applied to prevent contamination of spices.

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